Building Code
of
Cambridge, Massachusetts

1943

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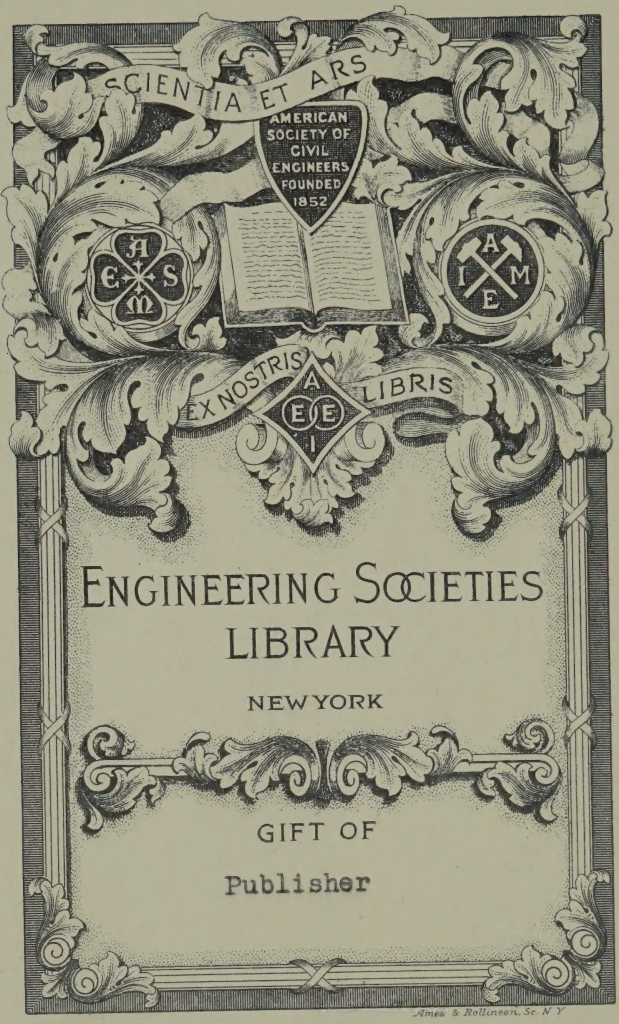
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CITY OF CAMBRIDGE
MASSACHUSETTS

BUILDING CODE

PUBLISHED BY
AUTHORITY OF THE COUNCIL OF THE
CITY OF CAMBRIDGE, MASSACHUSETTS
1943

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City of Cambridge

In the Year One Thousand Nine Hundred and Forty-three

AN ORDINANCE

ENTITLED "CONSTRUCTION, USE, MAINTENANCE AND INSPECTION OF
BUILDINGS AND STRUCTURES"

COVERING

The Construction, Alteration, Repair, Height, Area, Removal, Equipment, Occupation and Demolition of Buildings, Structures or Observation Stands and for the Plumbing, Gas Fitting and Building Wiring Therein, and for the Setting and Maintenance of Steam Boilers and Furnaces and the Installation and Alteration of Elevators.

0 - gift of Building Dept, Cambridge,

Foreword

The "Cambridge Building Code" is dedicated to the cause of better building construction as a safeguard to life and health of the inhabitants of Cambridge.

Committee appointed for the purpose of modernizing the Cambridge Building Code.

James J. Casey, Principal Assessor—Chairman
William M. Hogan, Jr., City Councillor—Vice Chairman
William L. Galvin, Member, Board of Appeal—Secretary
Frederick J. Adams, Associate Professor, Mass. Institute of Technology
Joseph Clarke, Member, Planning Board [a]
George L. Dow, Member, Planning Board
Edward F. Crane, City Councillor
Herman Gutheim, Chief, Fire Department
John H. Hegarty, Banker
Walter R. MacCornack, Dean, School of Architecture, M. I. T.
Haven Parker, City Councillor
John E. Quinn, Chairman, License Commission
Martin W. Ryan, Contractor and Builder
John J. Terry, Superintendent of Buildings
Frank Townsend, President, Chamber of Commerce
Aldrich Durant, Business Manager, Harvard University [b]

Technical Staff
L. C. Roy, *Building Code*

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[a] Deceased.

[b] In place of Joseph Clarke.

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Cambridge Building Code

PART I.

Organization.

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Sec. 101. Building department.

There shall be in the City of Cambridge, Massachusetts, a department, to be called the Building Department, which shall be under the charge and supervision of a Superintendent of Public Buildings, hereinafter referred to as the Superintendent, who shall also be the inspector of buildings.

Sec. 102. Appointment of superintendent.

The Superintendent shall be appointed by the city manager in accordance with the Civil Service Law; and he shall receive such salary as shall be fixed by ordinance. He shall have been domiciled in Cambridge for at least five (5) years immediately prior to such appointment.

Sec. 103. Duties of superintendent.

The Superintendent shall have charge of repairs and maintenance of all city-owned buildings not wholly in the charge of some other department or board. He shall have sole charge of the construction of buildings erected by the City of Cambridge or any department thereof. It shall be his duty to enforce the provisions of this Code, or of any subsequent amendment thereof. The Superintendent is hereby designated as the Inspector of Building Wiring, as provided in Chapter 208, Acts of 1941, entitled, "An act relative to the inspection and supervision of electrical wiring within buildings and structures in the City of Cambridge," approved April 24, 1941, and shall have all the power and supervision set forth in said chapter.

Sec. 104. Qualification of superintendent.

The Superintendent shall have had at least ten (10) years' experience as a structural engineer, a superintendent of building construction, an architect or a building inspector in the department.

Sec. 105. Acting superintendent.

The Superintendent shall have the power to appoint a member of the department to exercise all of the duties of the Superintendent during the absence or disability of the Superintendent.

Sec. 106. Employees.

1. The Superintendent shall appoint, in accordance with the Civil Service Laws, a clerk, building, wiring, plumbing, gas-fitting, and elevator inspectors, a structural engineer, or any such assistant as may be required for the general administration of the department. No person shall be appointed a building inspector who has not had at least five years' experience as a general building contractor, architect, engineer, superintendent of construction, or foreman in building construction.

2. The plumbing and gas fitting inspectors shall hold a master license in their respective trades for a period of at least three years prior to being appointed. The elevator inspector shall have had at least five years' experience in charge of the installation of elevators and escalators.

3. The present building wiring inspectors now employed in the Department of the City Electrician shall be transferred to the Building Department with the same duties, powers and rights as they hold at present and they shall be under the jurisdiction of the Superintendent.

4. The present officers and employees of the Building Department shall hold their several offices and positions during their term of office or until removed or discharged.

Sec. 107. Department regulations.

The Superintendent, structural engineer, inspectors and other office employees connected with the department shall not be engaged in the making of plans and writing of specifications or be interested in any other business pertinent to the building industry, except as an owner of a building or structure.

Sec. 108. Organization.

The Superintendent shall have the power to assign such duties to all the inspectors and employees as he may deem proper for the administration of the department and the enforcement of the building code and zoning law.

PART II.

Administration.

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Sec. 201. Short title.

This ordinance known as "Construction, Use, Maintenance and Inspection of Buildings and Structures" shall be referred to, throughout the text, as "this Code."

Sec. 202. Amendment to building code.

The Superintendent may from time to time recommend to the City Council such amendment of and additions to this Code as he may deem advisable. Such amendment, when approved by the City Council, shall become a part of this Code, as if hereto attached.

Sec. 203. Scope of building code.

a. General. 1. The provisions of this Code shall apply to the inspection, materials, construction, alterations, additions, repairs, height, area, removal, equipment, occupancy, location and maintenance of buildings and structures as herein described in this Code and as hereinafter set forth in the City, except such as are owned or occupied by the United States, the Commonwealth, portable school buildings erected and maintained by the City, voting booths erected and maintained by the Board of Election Commissioners, and except bridges, quays and wharves. Buildings and structures erected in the City of Cambridge by Middlesex County shall conform to the requirements of this Code.

2. The provisions of this Code shall be held to be the minimum requirements adopted for the promotion of the health, safety, convenience and welfare of the inhabitants. This Code shall not repeal, abrogate, annul or in any way impair or interfere with any existing provision of law or ordinance other than an ordinance entitled "Construction, Use, Maintenance and Inspection of Buildings" which is hereby repealed, or with any rules, regulations or permits previously adopted or issued or which shall be adopted or issued pursuant to law relating to the use of buildings or premises; nor shall this Code interfere with or abrogate or annul any easements, covenants or other agreements between parties; provided, however, that where this Code imposes a greater restriction upon the use of buildings or premises or upon height of buildings or requires larger yards, courts, or other open spaces than is imposed or required by such existing provision of law or ordinance, or by such easements, covenants or agreements, or by such rules, regulations or permits, the provisions of this Code shall control.

3. The regulations issued by the Massachusetts Department of Public Safety under Chapter 544 of the Acts of the year 1943 shall in no way affect this Code unless such regulations are more severe than this Code, in which case the regulations shall control.

b. Existing and Fire-Damaged Buildings. An existing building which is altered or repaired and said alterations or repairs costing, within any period of twelve months, in excess of fifty per cent of its assessed value, shall be made to conform to the requirements of this Code for new buildings. An existing building damaged by fire or otherwise, in excess of fifty per cent of its assessed value before such damage, shall be made to conform to the requirements of this Code for new buildings. If the cost of such alterations or repairs or the amount of such damage is more than twenty-five but not more than fifty per cent of the assessed value of the building, it shall be made to conform to such requirements in the portions so altered or repaired to such extent as the Superintendent may determine.

c. Additions to Buildings. A building now existing which is enlarged in aggregate floor area or in number of stories, which are not covered by the preceding paragraphs of this section, shall be made to conform throughout the entire building to the requirements of this Code in respect to egress and such other provisions as the Superintendent shall rule.

d. Repairs to Buildings or Structures. A building or structure now existing to which repairs and alterations are made, which are not covered by the preceding paragraphs of this section, may be repaired or altered, providing such alterations or repairs will not increase an existing nonconformity or hazard. Not more than twenty-five per cent of the roof covering of a building shall be replaced in any period of twelve months unless the entire roof covering is made to conform with the requirements of this Code for new buildings. New roofing meeting the requirements of this Code may not be placed over existing wood shingle roofing, the old wood roof covering must be removed before the new material is applied.

e. Moved Buildings. 1. When a building now existing is moved to another location, the owner must first consult the Superintendent and be assured that the new location and the building to be located thereon will conform with the Building Code and Zoning Ordinance.

2. A building moved to a new location shall be made to conform to all the provisions of this Code and Zoning Ordinance for new buildings.

f. Regulations of Other City Departments. Unless otherwise provided in this section, no provision of this Code shall be held to deprive any other department of the City of Cambridge either of any power or authority which it, he or they had on the effective date of this Code or of any remedy existing for the enforcement of its, his or their orders.

Sec. 204. Powers and duties of superintendent.

a. General. The Superintendent shall have full power to enforce and interpret any provision of this Code, and he may, himself or by his duly authorized representative, enter any building or premises in said City to perform any duty imposed upon him by this Code.

b. Interpretation of this Code. An architect, engineer or builder who is preparing plans for a building or structure in the City of Cambridge may make written request of the Superintendent for an interpretation of this Code as specifically applicable to such building or structure. The request shall be in writing, shall indicate the specific provision of this Code as to which interpretation is so desired, and shall contain or be accompanied by a description of the proposed work with plans sufficient to enable the Superintendent to form an opinion. The Superintendent shall make reply in writing within thirty days after receipt of the request either that the description of the proposed work is inadequate to form the basis of an opinion, or that he discerns no reason under the indicated provision of this Code for disallowing the proposed construction, or that his interpretation of such provision will not allow the proposed construction for reasons which he shall state. If the Superintendent shall interpret such provision as not allowing the proposed construction, such interpretation shall be deemed a disallowance thereof.

c. Power to Stop Work. Upon notice from the Superintendent that work on any building or structure is being done contrary to the provisions of this Code, or the permit issued, or in a dangerous or unsafe manner, such work shall be immediately stopped. Such notice shall be in writing and given to the owner of the property, or his agent, or the licensed builder or mechanic doing the work, and shall state the conditions under which work may be resumed.

d. Penalty for Hindering Superintendent in Performing His Duty. Whoever hinders or prevents, or attempts to hinder or prevent the Superintendent or his authorized representative from entering a building, structure or enclosure, or part thereof, in the performance of his duty in the enforcement of any provision of this Code shall be punished by a fine of not less than fifty dollars nor more than one hundred dollars. Each day during any portion of which such hindering continues shall be considered a separate offense.

e. Power of Superintendent Regarding Dangerous Structures. 1. The Superintendent, immediately upon being informed by report or otherwise that a building or other structure or anything attached to or connected therewith is dangerous to life or limb, shall inspect the same; and if it appears to him to be dangerous, he shall forthwith in writing notify the owner, agent or any person having an interest therein to remove it or make it safe. If it appears that such structure would be specially unsafe in case of fire, it shall be deemed dangerous within the meaning hereof, and the Superintendent may affix in a conspicuous place upon its exterior walls a notice of its dangerous condition, which shall not be removed or defaced without authority from him.

2. Any person so notified shall be allowed until twelve o'clock noon of the day following the service of the notice in which to begin to remove such structure or make it safe, and he shall employ sufficient

labor speedily to make it safe or remove it; but if the public safety so requires and if the City Council so orders, the Superintendent may immediately enter upon the premises with the necessary workmen and assistants and cause such unsafe structure to be made safe or taken down without delay, and a proper fence put up for the protection of passers-by, or the excavation, if such exists, shall be filled for a distance of 12 ft. from the property line.

3. If an owner, agent or person interested in such unsafe structure refuses or neglects to comply with the requirements of such notice within the time limited, and such structure is not made safe or taken down as therein ordered, a careful survey of the premises shall be made by a board consisting of the City Engineer, the Chief Engineer of the Fire Department and one disinterested person to be appointed by the Superintendent. A written report of such survey shall be made, and a copy thereof served on such owner, agent or interested person.

4. If such report declares such structure to be dangerous, and if the owner, agent or person interested continues such refusal or neglect, the Superintendent shall cause it to be made safe or taken down, and the costs and charges incurred shall constitute a lien upon the land upon which the building is located, and shall be enforced within the time and in the manner provided for the collection of taxes on land; and such owner or interested person shall, for every day's continuance of such refusal or neglect after being so notified, forfeit to the city in which the structure is located not less than ten dollars nor more than fifty dollars.

5. An owner or interested person aggrieved by such order may have the remedy prescribed by section two of chapter one hundred and thirty-nine of the General Laws; but this section shall not prevent the City from recovering the forfeiture provided in the preceding section from the date of the service of the original notice, unless the order is annulled by the jury.

6. If the owner or interested person lives out of the Commonwealth, the notice required above may be served upon him by a notary public whose certificate of service under his notarial seal shall be sufficient evidence thereof.

f. Requirements Not Specifically Covered by Code. Any requirement necessary for the strength or stability of an existing or proposed structure or for the safety of the occupants thereof, not specifically covered by this Code, shall be determined by the Superintendent.

g. Demolition of Buildings and Structures. The Superintendent shall make and issue rules and regulations governing the demolition of buildings and structures.

h. Alternate Materials and Construction Methods. Whoever desires to substitute for the materials or methods covered by this Code, materials or methods of construction or maintenance not covered thereby, shall present to the Superintendent plans, methods of analysis, and tests or other information substantiating the analysis of the system or qualities of the material and shall make such additional tests or present satisfactory evidence of such tests as the Superintendent may require. The costs of any tests required to determine acceptability of substitute materials or methods shall be paid by the applicant. When the strength of any construction cannot be satisfactorily determined by the application of accepted engineering principles, its safe strength shall be determined as one third the ultimate strength evidenced by tests of full size units or assemblies thereof of such construction so loaded as to produce critical stresses. Such materials or methods of construction shall not be used until after the Superintendent has issued regulations fixing the practices to be followed, but no such regulation shall have the effect of altering the working stresses for any material herein mentioned or of reducing the fire-resistive and fire-protective requirements of this Code. A substitution of materials or method of construction, other than that specified in this Code, may be allowed, but only with the written consent of the Superintendent.

Sec. 205. Records.

a. Applications, Plans, Specifications. All applications, plans and specifications shall be consecutively numbered, indexed and filed as permanent record. Applications that have been refused shall be suitably indexed and filed as permanent record.

b. Reports and Orders. The original reports of inspection made by the Department inspectors and a copy of all orders issued by the Department shall be retained as a permanent record and shall be suitably filed.

c. Correspondence. Copies of all letters and other correspondence of the Department shall be suitably filed and retained for at least six years.

d. Records Open to Public. All records of the Department, except plans and specifications, shall be public records. Plans and specifications shall not be subject to inspection by persons other than the persons filing them, and the owner of the premises affected, or the architect or engineer who prepared such plans and specifications, except by order of the Superintendent or of a Court of Law or Chancery.

Sec. 206. Superintendent's annual report.

The Superintendent shall annually, not later than February first, submit a report to the city manager, covering the work of the department during the preceding period, and shall incorporate in said report a summary of the decisions of the Board of Appeal, a summary of the proceedings of the Board of Examiners during said period, and a summary of his recommendations as to desirable amendments to this Code in accordance with section 202.

Sec. 207. Permits.

a. When Permit is Required. 1. A permit issued by this department shall be required before any work is started on the construction, alteration, addition, removal, equipment, occupation, electrical wiring. plumbing, gas fitting of buildings, alter or substantially repair plumbing, gas fitting, electrical wiring, signs and billboards, mechanical refrigeration, sprinkler systems or elevators, or to install a steam boiler, furnace heater, or other heat producing apparatus and equipment, the installation of which is regulated by this Code.

2. No such work shall be started without such a permit, nor no such work shall be done, nor shall changes be made during construction except in accordance with original drawings or amended drawings, or both, bearing the approval of the Superintendent.

3. Permits for various trades shall be issued in accordance with section 210 for plumbing, gas fitting, heating, ventilation, wiring, mechanical refrigeration and lathing.

b. Other Permits or Approvals Required. In addition to the permits required from the Building Department, it will be necessary to obtain permits from the City of Cambridge Health Department for the following occupancies: undertaking establishments, vapor bath and massage establishments, manufacturing of non-alcoholic beverages, milk pasteurization, ice cream making, slaughter houses, stables, sale of live animals, rendering plants, soap manufacturing, and alcohol rectifying plants. Also all public buildings and places of assembly as defined under chapters 544 and 546 of the Acts of the year 1943 shall conform to the requirements of the Massachusetts Department of Public Safety. It will be necessary to obtain the approval of the

Massachusetts Department of Public Safety for use of buildings in whole or in part, as a public building, or as a factory, workshop or mercantile or other establishment, and to have accommodations for ten or more employees, and no building more than two stories in height designed to be used above the second story, or in which alteration shall be made for the purpose of using it, or continuing its use in whole or in part, as an office building, dormitory, hotel, family hotel, apartment house, boarding house, lodging house or tenement house, and to have eight or more rooms above said story, shall be erected, and no alteration shall be made therein, until a copy of the plans and specifications thereof has been deposited with the supervisor of plans by the person causing its erection or alteration or by the architect thereof.

c. Special Permits. 1. No building shall be used for a grain elevator or chemical works, and no boiler, engine, dynamo, furnace, or machinery for alteration, transmission, or application of power except for domestic purposes shall be placed in any building without a special permit from the Superintendent covering such installation; provided, however, that the provisions of this paragraph shall not apply to installations for power or heating for dwellings, nor to installations of machinery for heating, ventilating, and elevator purposes, nor to the plants of the City of Cambridge, the Cambridge Electric Light Company, the Cambridge Gas Light Company and the Boston Elevated Company, nor to extensions or additions to existing plants or installations unless such extensions or additions shall, in the opinion of the Superintendent, be of a nature to become a nuisance or to injure the character of the neighborhood.

2. Every application for such special permit shall be in writing in such form as the Superintendent may require. The Superintendent shall prepare an ad to be published by the applicant in a newspaper published in the City of Cambridge, and the applicant shall also post conspicuously on the premises, a copy of the newspaper advertisement and shall deliver personally or by mail, postage prepaid, copies thereof to all the neighbors within a distance of 100 ft. from the property lines of the lot upon which the installation is proposed, and to such other persons as the Superintendent shall designate. The applicant shall submit to the Superintendent an affidavit stating that he has complied with the provisions of this section.

3. If no objection is filed with the Superintendent before the expiration of 10 days after the publication of the notice or within 10 days of the delivery or mailing and first posting of such notice if re-

quired, the Superintendent shall, if the arrangement, location, construction, and character of the proposed apparatus is proper, suitable to the neighborhood, and in accordance with the provisions of this Code, issue a permit for the same. If the objection is filed by anyone within the time above mentioned, the application shall be referred to the Board of Appeal. After such notice as the board shall order, it shall hold a hearing and shall direct the Superintendent to issue a permit under such conditions as it may prescribe, or withhold the issuance of permit at its discretion.

d. Permits for Alterations. Permits for alterations involving structural changes, and for small buildings, may be issued upon presentation of an application on a special form, to be furnished by the Building Department, and payment of the required fee.

e. Application for Permits. 1. All applications for permits under the provisions of this Code shall be in writing, on forms furnished by the Building Department. Such application shall state the name and address of the owner or owners and the contractor, and shall be signed by the licensed builder who shall have charge of the work. Each application that is approved by the Building Department shall bear the signature of the Superintendent or his authorized representative and the date of issuance.

2. Each application shall indicate the proposed occupancy of all parts of the building and the distances from the lot lines to the proposed structure and shall contain such other information as may be required by the Superintendent.

3. The Superintendent may require the material facts contained in each such application to be certified by the applicant under oath.

f. Issue of Permits. 1. If the Superintendent is satisfied that the work described in an application for permit conforms to the requirements of this Code and other pertinent laws and ordinances, and if the person designated by signature on the application as the person who will perform or take charge of the work is duly licensed, the Superintendent shall issue a permit therefor to the applicant.

2. The Superintendent shall act upon an application for a permit with plans as filed, or as amended, without unreasonable or unnecessary delay. A permit issued shall be construed to be a license to proceed with the work and shall not be construed as authority to violate, cancel, alter or set aside any of the provisions of this Code, nor shall such issuance of a permit prevent the Superintendent from thereafter requiring correction of errors in plans or in construction or of violations of this Code.

3. When the Superintendent issues a permit, he shall endorse in writing, or stamp, both sets of plans "Approved." One set of plans so approved shall be retained by the Superintendent and the other set shall be signed by him, dated, returned to the applicant and shall be kept at the site of work and shall be open to inspection at all reasonable times by the Superintendent or his authorized representative.

g. Refusal to Issue Permit. If the application for a permit and the plans filed therewith describe work which does not conform to the requirements of this Code or other pertinent laws or ordinances, the Superintendent shall not issue a permit, but shall return the plans to the applicant with his refusal to issue such permit. Such refusal when requested shall be in writing and shall contain the reasons therefor.

h. Superintendent to Notify Assessors. The Superintendent shall give written notice to the assessors of the City of Cambridge, of the granting by him of permits for the construction of any building or structure therein or for any substantial alteration therein or addition thereto. Such notice shall be given within seven (7) days after the granting of each permit, and shall state the name of the person to whom the permit was granted, the name of the owner of building or structure and the location of the building or structure to be constructed or altered or to which an addition is to be made.

i. Special Supervision. Whenever a permit is to be issued in reliance upon an affidavit as provided in Section 207-J-3 or whenever the work to be covered by a permit involves construction under conditions which in the opinion of the Superintendent are hazardous or complex, the Superintendent shall require that the architect or engineer who signed the affidavit or made the plans or computations shall supervise such work, be responsible for its conformity with the approved plans, and forthwith upon its completion make and file with the Superintendent written affidavit that the work has been done in conformity with the approved plans and with the structural provisions of this Code. In the event that such architect or engineer is not available, a competent person whose qualifications are approved by the Superintendent shall be employed by the owner in his stead.

j. Filing of Plans. 1. Unless the Superintendent should choose to make an exception, all applications for permit must be accompanied with duplicate sets of plans drawn with sufficient clarity and detail so as to indicate the nature and character of the work. Such plans shall contain information, in the form of notes or otherwise, as to the quality of materials where quality is essential to conformity with this Code. Such information shall be specific, and this Code shall not be cited as a whole or in part, nor shall the term "legal" or its equivalent be used, as a substitute for specific information.

2. The Superintendent may require details, computations, stress diagrams and other data necessary to describe the construction and basis of calculations. He will also require plans showing the location of the proposed building and of every existing building on the lot, unless the work is in the nature of minor repair and he deems it unnecessary to have such a plan. He may require the necessary plans and computations to bear the signature of the architect or engineer who prepared such plans.

3. The Superintendent shall examine each application for permit and the plans and computations filed therewith and shall ascertain by such examination or affidavit of the architect or engineer who has signed the plans and computations, or otherwise, whether the construction indicated and described is in accordance with the requirements of this Code and of all other pertinent laws or ordinances.

k. Approval in Part. When application for permit to erect or enlarge a building has been filed, and pending issuance of such permit, the Superintendent may, at his discretion, upon payment of the required fee, issue a preliminary permit for the foundations of such building. The holder of such a preliminary permit shall proceed only at his own risk and without assurance that a permit for the superstructure will be granted.

l. Posting of Permit. With each and every permit issued for buildings or other structures, the Building Department shall issue to the owner or his agent a card properly filled out and it shall be his duty to place and maintain such card in a conspicuous place on the premises where the building operation is in progress, the card to be unobstructed from the public view and shall not be attached to any tree which may be growing in any public street or place, or upon any existing pole or lamp post.

m. Time limitation. Permits for structures upon which work is not started within 6 months of date of issue, and permits for structures, work upon which has been abandoned for 6 months, shall lapse and cease to be in effect. The Superintendent may within 6 months of the date of such permit's lapse reinstate them, but such reinstatement shall not be obligatory, but only at his discretion. Permits which have lapsed for more than 6 months shall be void.

n. Revocations. Whenever it shall be found that a permit has been issued in violation of this Code or any other ordinance or State law or in consequence of a false statement of facts, or misrepresentation of conditions, the Superintendent shall notify the person holding such permit to appear before him at a stated time and show cause why such a permit should not be revoked. If, after such a hearing, or in case the holder of the permit does not appear, after the time set for the hearing has elapsed, it still appears that such a permit was not properly issued, the Superintendent shall issue a written order revoking same and shall then proceed as if no permit had been issued. When any permit is revoked, the fee paid for such permit shall not be returned.

Sec. 208. Fees.

a. General. Any person desiring a building permit shall, at the time of filing an application therefor, as provided in Section 207, pay to the Superintendent a fee as required in this section.

b. Method of Payment. In all cases, fees for permits shall be paid by the owner or by the person, persons or concern authorized by the owner to perform the actual work. When work is to be done under a general contract, the owner or the general contractor shall pay the fees for all lines of work. When any line of work is to be done under a separate contract or independently of any other contract, then the fee covering such line of work shall be paid by the owner or by the person, persons or concern authorized by the owner to perform such line of work.

c. Valuation of Cost of Work. The owner, agent or contractor shall submit with the application for permit an estimated cost of the work to be done and shall deposit a fee based upon such estimated cost. At the completion of the work the licensed contractor shall file a sworn affidavit of the actual cost to the owner of the work and shall then pay the difference between the amount of the original fee paid and the fee computed on such actual cost. In case the actual cost is less than the original estimated cost a refund of the difference shall be made to the person or concern depositing the original fee. The Superintendent may require proof of the accuracy of the cost stated in the above affidavit and in case such proof is not produced may, at the expense of the owner, have an appraisal of such work made by competent appraisers and may compute the fee on such appraised valuation.

Description	*Fee*
1. Residence buildings of Group I occupancy	$5.00
2. All other buildings and structures, except garages for more than 3 cars and private garages.	$1.00 per $1000 or fraction thereof. Max. fee $1000 Min. fee $5.00
3. Garages for more than 3 cars	Min. fee $5.00 up to $5000 valuation $1.00 per $1000 or fraction thereof above $5000
4. Alterations and Additions to cost less than $300	$1.00
Over $300 and less than $10,000	$5.00
$10,000 and over	$1.00 per $1000 or fraction thereof. Max. fee $200
5. Amendments to plans	$1.00 per $1000 of cost of work in excess of $1000. No fee if cost is $1000 or less
6. Demolition of buildings or structures	$3.00
7. Boilers, engines, etc.	$1.00
8. New plumbing	$5.00 Min. up to 8 fixtures, .25 per fixture above 8, $25.00 Max.
9. Alterations in plumbing	$2.00
10. New gas fitting	$2.00
11. Alterations in gas fitting	$ .50
12. Installation of elevators	$3.00
13. Fees for permits for sheds, private garages, and like structures, and for preliminary permits as described under Section 207 k shall be determined at the discretion of the Superintendent—but not to exceed $5.00.	
14. All Signs, including Billboards less than 100 sq. ft. in area	$1.00
15. All Signs and Billboards 100 sq. ft. or over	$.02 per sq. ft.
16. Refrigerating systems. (No permit shall be required for single-room units)	$5.00
17. Petition to Board of Appeal	$15.00

d. Electrical Fees. Initial charge made on all permits issued $0.75

1. *Incandescent Lamps.*

1 to 2	50 Watt Incandescent Lamps or equivalent	$ .25
3 to 4	50 Watt Incandescent Lamps or equivalent	.50
5 to 6	50 Watt Incandescent Lamps or equivalent	.75
7 to 10	50 Watt Incandescent Lamps or equivalent	1.00
11 to 15	50 Watt Incandescent Lamps or equivalent	1.50
16 to 20	50 Watt Incandescent Lamps or equivalent	2.00
21 to 30	50 Watt Incandescent Lamps or equivalent	2.50
31 to 40	50 Watt Incandescent Lamps or equivalent	3.00
41 to 50	50 Watt Incandescent Lamps or equivalent	3.50
51 to 60	50 Watt Incandescent Lamps or equivalent	4.00
61 to 70	50 Watt Incandescent Lamps or equivalent	4.50
71 to 80	50 Watt Incandescent Lamps or equivalent	5.00
81 to 90	50 Watt Incandescent Lamps or equivalent	5.50
91 to 100	50 Watt Incandescent Lamps or equivalent	6.00

Each twenty-five 50 watt lamps, or equivalent, or fractional parts thereof, in excess of 100........................ 1.00

Where the number of lamps to be connected to outlets is unknown, each circuit will be charged for on the basis of 1650 watts per circuit.

Where feeders or mains only are run, the load to be connected to same not being determined, the fees shall be figured on the energy to be consumed, based on the current carrying capacity of conductors, relating to the allowable carrying capacity of wires, fee to be one-half that which would be charged providing branch circuits, etc., were installed.

No fee shall be less than 25 cents.

2. *Fixtures.*

1 to 3	50 Watt Lamps or equivalent	$ .25
4 to 6	50 Watt Lamps or equivalent	.50
7 to 10	50 Watt Lamps or equivalent	1.00
11 to 15	50 Watt Lamps or equivalent	1.50
16 to 20	50 Watt Lamps or equivalent	2.00
21 to 25	50 Watt Lamps or equivalent	2.50

Each 25 lamps or fractional part thereof in excess of 25.... .50

3. *Motors.*

Charges for motor installations of 1 horse power or over will be on the following basis:

TABLE SHOWING PERMIT FEES FOR MOTORS:

H. P.		H. P.	
Less than 1 H. P.	$ .50		
1	1.00	10	$3.25
2	1.25	11	3.50
3	1.50	12	3.75
4	1.75	13	4.00
5	2.00	14	4.25
6	2.25	15	4.50
7	2.50	16	4.75
8	2.75	17 to 25	5.00
9	3.00	26 and above	10.00

Charges for installations of less than 1 horse power will be at the rate of 50 cents for each motor.

Where several motors are installed, capacity of each being less than ¼ horse power, charge for permit will be based on total wattage connected.

Where several motors are to be installed on the same premises, at same time and for the same party, the sum of the horse power of such motors as are over 3 horse power each and not exceeding 17 horse power shall be used to compute required fee for same, the first 3 horse power being $1.50 and each additional horse power being 25 cents; charge for no motor, however, to exceed $10.00.

Where feeders or mains are run the load to be connected to same not being determined, the fees shall be figured on the energy to be consumed based on the current carrying capacity of conductors, relating to the allowable carrying capacity of wires; fee to be one-half that which would be charged providing load was connected to same.

Where work of installation of motor and the work of installation of wiring, etc., is done by different parties one-half of the total fee shall be charged each party; that is, one-half of the fee which would cover mains with load connected to same.

Rectifiers and battery charging equipments of any description shall be charged at the rate on the scale of the incandescent lamps.

4. *Heating Devices.*

Each device 660 watts or under	$ .75
Each device over 660 and not over 1000 watts	1.50
Each device over 1000 watts and not over 2000 watts	2.00
Each 1000 watts or fractional part thereof above 2000 watts	.25

Where several heaters are to be installed at the same premises, at same time and for the same party, the sum of the watts of the heaters shall be used as a basis to compute required fee for same, and the first 2000 watts shall be charged for at the rate of $2.00, each additional 1000 watts or fractional part thereof being 25 cents.

Where feeders or mains are run the load to be connected to same not being determined, the fees shall be figured on the energy to be consumed based on the current carrying capacity of conductors, relating to the allowable capacities of wires. Where feeders or mains are in excess of 2000 watts capacity and wiring only is installed, but one-half of this fee shall be required, balance to be charged for permit when device is installed.

5. *Electric Sign and Marquee Installations.*

Charges will be on the basis of incandescent lamp installations, each 50 watts capacity being rated as one incandescent lamp.

Where work in connection with sign installation is divided between two or more parties, the fee charged each party shall not be more than one-half the total fees.

For multiple work no lamp will be considered as less than 10 watts.

Where sign has not been previously passed upon and approved by this Department, which may be the case in signs not manufactured in this city, the party connecting same shall pay the entire fee.

NEON SIGN AND OUTLINE INSTALLATION

Charge for neon sign and outline lighting shall be based on number of transformers in each sign or outline unit:

1 to 3 transformers	$1.50
Each additional transformer in excess of 3	.50

For combination neon and incandescent signs the permit fees specified for incandescent signs shall be added to those for neon signs.

Alterations and repairs on signs due to defective conditions there shall be charged a fee	$ .75

6. *Source of Supply.*

Service and meter connections, each	$ .75
Generators of 10 kilowatt capacity or less	2.00
Generators of 11 to 25 kilowatt capacity	3.00
Generators of over 25 kilowatt capacity	5.00
Transformers of 10 kva capacity or less LOW TENSION	2.00
Transformers of 11 to 25 kva capacity LOW TENSION	3.00
Transformers of over 25 kva capacity LOW TENSION	5.00
HIGH TENSION TRANSFORMER VAULT EQUIPMENT	10.00
Signalling and ignition transformers, each	.50

7. *Motion Picture Machines, Stereopticons or Similar Apparatus,* each	$1.00

8. *Temporary Work* (30 days or less).

Permits for all work of a temporary character shall be charged for at the rate of one-third of that charged for permanent construction, except that in no case shall fee be less than 50 cents.

9. The fee for alterations and relocations will be the same as that charged for new work.

10. A charge of 75 cents will be made for inspection of corrected defective work. (When defects reported by the Department have been corrected, a permit must be obtained before reinspection may be made.)

11. *Duplicate Permits,* each	$ .75

Each 50 watt (or less) incandescent lamp, except sign lamps, will be rated as one unit and charged for accordingly.

Each arc lamp or mercury vapor lamp to be rated as equivalent to ten 50-watt lamps.

12. *Work Done by Others than Electrical Contractors, etc.*

Any person, firm or corporation, other than electrical contractor and public service corporation who employs one or more electricians permanently to do electrical work, may obtain a permit, covering the work done by such permanent electrician for a period of time, to be determined in each case. The fee for electrical work done under such permit will be the same according to this schedule that would be charged had a separate permit been given for each job. A preliminary fee of $1.00 will be charged for each permit issued.

e. Fees for Work Started Prior to Obtaining Permit.

Where work for which a permit is required by this Code is started or proceeded with prior to obtaining said permit, the fees previously specified shall be doubled, but the payment of such double fee shall not relieve any persons from fully complying with the requirements of this Code in the execution of the work nor from any other penalties prescribed herein.

f. Record and Transfer of Fees. The Superintendent shall keep a permanent, accurate account of all fees and other monies collected and received under this Code, the names of the persons upon whose account the same were paid, and the date and amount thereof. Such fees and monies shall be transferred to the office of the City Treasurer at the end of each day of business.

Sec. 209. Certificate of occupancy.

a. Certificate of Occupancy Required. It shall be unlawful to use or permit the use of any building or premises or part thereof hereinafter created, erected, changed or converted wholly or partly in its use or structure, except single and two-family dwellings, until a certificate of occupancy to the effect that the building or premises or part thereof so created, erected, changed or converted and the proposed use thereof conform to the provisions of this Code shall have been issued by the Superintendent. In the case of such buildings or premises it shall be the duty of the Superintendent to issue a certificate of occupancy within ten days after a request for the same shall be filed in his office by any owner of a building or premises affected by this Code, provided said building or premises, or the part thereof, conforms with all the requirements herein set forth. Upon written request from the owner, the Superintendent shall issue a certificate of occupancy for any building or premises existing at the time of the passage of this Code certifying after inspection the use of the building or premises and whether such use conforms to the provisions of this Code. Certificates of occupancy shall remain in force until revoked, altered, or voided as herein provided.

b. Temporary Certificate of Occupancy. Pending the issuance of a regular certificate of occupancy, a temporary certificate may be issued for such period, not exceeding 6 months, as the Superintendent may designate, during the completion of alterations required by him in accordance with the provisions of this Code, or during partial occupancy of a building pending its completion. Such temporary certificates of occupancy shall be issued under such restrictions and provisions as the Superintendent may order for the safety of the occupants. No temporary certificate of occupancy shall be issued if, in the opinion of the Superintendent, the building fails to conform to the provisions of this Code or regulations issued under it to such a degree as to render it unsafe for the occupancy proposed.

c. Changed Occupancy. 1. If the conditions of use or occupancy of any building or part thereof are substantially changed, or so changed as not to be in conformity with the conditions required by a certificate of occupancy issued therefor, said certificate shall be void and the owner shall notify the Superintendent who shall order an inspection of the building. The owner shall make the building conform to the requirements of this Code for such new use or occupancy as directed by the Superintendent and a new certificate shall thereupon be issued as herein provided.

2. If, on any inspection, the conditions of a building or its use or occupancy are found not to conform to the requirements of this Code or the conditions of an existing certificate therefor, the Superintendent shall at once issue written notice to the owner, specifying the manner in which the building fails to so conform, and the owner shall at once take steps to make it so conform, as directed by the Superintendent; and if the Superintendent deems it necessary for the proper protection of the occupants, he may order the use or the occupancy of the building modified or the building vacated until its condition is made satisfactory in conformity with this Code, at which time a certificate shall be issued as herein provided.

d. Certificate Evidence of Compliance with This Code. A certificate of occupancy issued as herein provided shall be conclusive evidence of compliance with the provisions of this Code, its regulations, and other ordinances having effect at the time of its issuance, subject only to its being made void by act or neglect of the owner as herein provided.

Sec. 210. Inspection.

a. General. 1. Where the word "Superintendent" appears in this section, it shall also mean "his duly authorized representative."

2. The Superintendent shall inspect at various intervals during the erection, construction, enlarging, alteration, repairing, moving, demolition, conversion, occupancy and underpinning all buildings or structures referred to in this Code, and a final inspection shall be made of every building or structure hereafter erected prior to the issuance of the certificate of occupancy as required in Section 209.

b. Inspection of Plumbing, Gas Fitting. The Superintendent shall make an inspection of the installation, construction, alteration, or repair of, or addition to any plumbing, gas fitting or drainage for which a permit has been issued. No plumbing or gas piping shall be used until the same shall have been found to be in accordance with the provisions of this Code.

c. Inspection of Heating, Ventilating and Power Equipment. The Superintendent shall make an inspection of the installation, alteration or addition to any furnace or any fan, blower, piping, ducts, radiators, or registers used in connection with a heating or ventilating system, for which a permit has been issued, and it shall be unlawful to use any such heating and ventilating system or part thereof, until the same shall have been found to be in accordance with the provisions of this Code.

d. Inspection of Refrigerating and Cooling Systems. The Superintendent shall make an inspection of the installation, construction, alteration, or addition to any cooling or refrigerating system for which a permit has been issued, and it shall be unlawful to use any such system or part thereof until the same shall have been found to be in accordance with the provisions of this Code.

e. Inspection of Electrical Wiring and Appliances. The Superintendent shall make an inspection of all wiring, conduits, fittings and appliances for which a permit has been issued. He may require the person who performed the work to be present during inspection. A certificate of approval shall be issued upon acceptance of the work. Such installation shall not be connected to the service, nor have current turned on, until a certificate has been issued.

f. Inspection for Lathing. No wall or ceiling of any building shall be lathed or otherwise covered until the Superintendent has been notified that the building is ready for such work and he has issued a permit of approval thereof. Such permit of approval shall imply that all other required inspections, as outlined under this section, have been completed and approved. The Superintendent shall act upon such a lathing permit within two days after notification by the owner.

g. Inspection and Certificate for Elevators. All elevators and escalators shall conform to the requirements framed by the Board of Elevator Regulations and published by the Massachusetts Department of Public Safety, as outlined under Form H, governing the installation, inspection and operation of elevators.

h. Inspection of Existing Buildings and Appliances. The Superintendent shall from time to time, as he deems proper, inspect all buildings, iron fire escapes, signs and advertising devices, gas piping, gas fixtures and appliances, electrical wiring and appliances, and the drainage, plumbing, water supply, plumbing fixtures and appliances in any building and shall make such rules, regulations and requirements relating thereto as he deems safety requires, and the owner of such building shall comply therewith. The materials used and work performed in gas-fitting and plumbing shall be subject to such regulations as may be made by the Superintendent.

i. Inspection of Signs. The Superintendent shall make an inspection of each installation included under the provisions of Part 36 to ascertain if such installation is in compliance with the provisions of this Code.

j. Inspection on the Posting of Floor Loads. The Superintendent shall require the owner of every warehouse, storage or manufacturing building, or the storage portion of any mercantile building to comply to the provisions set forth under Section 2308.

Sec. 211. Board of appeal.

a. Board of Appeal. There shall be a board to be called the Board of Appeal, which shall be appointed by the City Manager, and consisting of three members, including always one architect, and one master builder. The Superintendent, or his duly authorized representative, shall be present at each meeting of the Board of Appeal.

b. Definitions. For the purpose of this section a master builder shall have had at least 5 years of recent building experience erecting structures of a substantial nature. An architect shall have had at least 5 years of recent experience in the design and supervision of buildings of a substantial nature and shall be registered by the Commonwealth of Massachusetts.

c. Appointment. 1. In the month of February of each year the City Manager shall appoint one member of said board, who shall hold office for a term of 3 years from the first day of March following. A member of the board shall be appointed annually by the City Manager to act as chairman of said board.

2. The present members of the Board of Appeal shall hold their positions during their respective terms of office unless removed according to law.

3. The City Manager shall likewise fill all vacancies in said board caused by death, resignation, or removal, for any unexpired term.

4. Members of said board shall hold office until their successors shall have been appointed and shall have qualified.

5. No member of said board shall sit on a case in which he is interested, and in case of disqualification, or of the necessary absence of any member, the chairman shall designate a substitute. If two or more members are so disqualified or absent, the City Manager shall designate substitutes to act during disqualification or absence.

d. Associate Members. In like manner, the City Manager may appoint 3 associate members, who may be designated by the chairman of the board, or the City Manager, as described above, to act in case of disqualification of any member or in cases involving personal interest or necessary absence on the part of any member.

e. Clerk of the Board. A clerk of the Building Department shall act as clerk of said board.

f. Expenditures of Board. Each member or associate member of said board shall be paid ten dollars per day for actual service but not more than five hundred dollars in any one year. The reasonable expenses of said board, including such clerical assistance and office expenses as shall be approved by the City Manager, shall be paid.

g. Appeals. 1. An applicant for a permit whose application has been refused by the Superintendent may appeal therefrom within 90 days of the date of refusal. A person may appeal from any other decision of the Superintendent within 10 days after being notified of such decision by giving the Superintendent notice in writing of his appeal. Said notice or a certified copy thereof shall be at once transmitted by the Superintendent to the Board of Appeal.

2. Such written notice of appeal shall be accompanied by payment in cash, of cost of advertising and mailing for notice required, if any.

h. Decision of the Board of Appeal. 1. After notice to the appealing party, to the Superintendent, to the abutters and to such other parties as the Board shall order, a hearing shall be had, and said Board shall affirm, annul or modify said refusal or decision.

2. Every decision of said board shall be in writing, shall require the assent of all members of the board in cases involving the Building Code (except as otherwise provided in the Zoning Ordinance) and shall be filed in the office of the Superintendent within 10 days

after the hearing. A certified copy shall be sent by mail or otherwise to the applicant, and a copy publicly posted in the office of the Superintendent for two weeks thereafter. If the order or refusal of the Superintendent is affirmed, such order or refusal shall have full force and effect. If said order or refusal is modified or annulled, the Superintendent shall immediately issue a permit in accordance therewith provided the appeal pertains to a building or structure. However, if the appeal pertains to the Zoning Law, he shall issue a permit 15 days after the Board of Appeal's decision has been filed with the City Clerk.

i. Time Limit for Renewal of Appeal. When an appeal is made to the Board of Appeal and a decision rendered, no further petition relative to the same building, structure or land shall be considered for a period of at least six months, unless in the opinion of the Superintendent the new petition is substantially different in character from the one previously submitted.

j. Annual Report of Board of Appeal. It shall be the duty of the Board of Appeal to submit to the City Manager on or before the first of December of each year a report giving a summary of all decisions of the Board, together with such recommendations of revisions of this Code as may seem advisable.

Sec. 212. Board of examiners.

a. Board of Examiners. There is hereby established in the City of Cambridge a board of examiners to consist of three members appointed by the City Manager. The three members shall include an architect, an engineer, and a master building contractor. When an examination is held for a gas fitter, the local gas inspector, who shall be a licensed gas fitter, shall sit on the board with the above mentioned members. The Superintendent shall be present at each meeting of the Board of Examiners.

b. Clerk for Board of Examiners. A clerk of the Building Department shall act as clerk of the Board of Examiners.

c. Appointments. Said Board of Examiners shall exercise the powers and perform the duties herein provided. Upon the expiration of the term of office of a member of said board his successor shall be appointed for the term of three years; and subsequent appointments to said board shall be for terms of three years each. Vacancies shall be filled by appointment by the City Manager for the remainder of the unexpired term. Each member shall serve without compensation.

d. Examinations. Said Board of Examiners shall hold examinations, under rules and regulations adopted by it, of persons desiring to be registered as qualified to have charge or control of the construction, alteration, removal or tearing down of buildings or structures, or the installation or repair of elevators, escalators and gas piping. Due notice of the time and place for such examinations shall be posted in the office of the Building Department.

e. Classes of Licenses. Said board shall establish various classes of licenses to be issued, and each class shall be for a specific type of work. Said board shall determine the qualifications required for each class, and after examination shall register in each class the persons found to possess the requisite qualifications therefor. The name and address of each person so found to be qualified, with the designation of the class in which he is registered, shall thereupon be certified by said board to the Superintendent, who shall make a record thereof, which shall be open to public inspection.

f. When Licensing Takes Effect. Ninety days after this Code is enacted as an ordinance, it shall be considered a violation of this Code to erect, enlarge, repair, move and demolish buildings and structures and install and repair elevators, escalators and do gas piping in the City of Cambridge without the required license. Such work shall be under the direct charge, control and personal supervision of the licensee and it shall be performed in a manner which shall preserve the public safety and conform to this Code and all other pertinent laws and ordinances.

g. License by Affidavit. Any person who shall, by affidavit, together with such other evidence as may be required by said Board of Examiners show to it, that he has had charge or control of such work in the class in which he applied to be registered, and shall satisfy the board that he is qualified by education, training and experience to have charge or control of such work, may, without other examination, be registered in such class and be certified to the Superintendent as a person qualified within such class.

h. Renewal of License. Said Board of Examiners, upon payment of the required fee by the licensee shall issue a license, to each person so certified by it to the Superintendent. Each license shall expire one year from the date of its issuance. Said board shall renew a license, upon the expiration thereof and upon payment of the required fee therefor, for the further period of one year from the date of renewal.

i. Fee. The fee to be paid to the Building Department for such license and renewals shall be $5.00 upon qualification for single class or combination of classes, $2.00 for annual renewal, if renewed within 30 days of expiration of old license, $5.00 for reissue after 30 days have elapsed.

j. Duties, Responsibility of Licensee. Any person who is duly licensed as aforesaid shall be entitled to have charge or control of any work described in this section, in the class in which he is registered, until his license is revoked or suspended by the Superintendent, upon the order of said Board of Examiners. No such license shall be revoked or suspended except upon proof, satisfactory to said board, of specific charges, filed with said board by the Superintendent, or other person, that the licensee has been careless or negligent in the performance of his duty in connection with work under his charge or control, or has caused or permitted a violation of this Code in connection therewith, or that this Code has been violated in connection with such work and that the licensee, being in charge of such work, knew, or in the exercise of due diligence, should have known of such violation. Upon learning of such carelessness, neglect of duty or violation of this Code, the Superintendent shall file charges with said board and prosecute them. Upon the filing thereof by the Superintendent or other person, said board shall give to the licensee notice of a hearing thereon, which hearing shall be held by said board not less than seven days after date of said notice. Such notice shall be served upon the licensee either by service in hand or by registered mail, shall state the time and place of the hearing and shall contain a copy of the charges. At such hearing the licensee may be represented by counsel, and the Superintendent may be assisted by a representative of the Law Department of the City.

k. Termination of Job by Licensee. If, for any cause, a person licensed as herein provided shall cease to have charge or control of work described in this section before such work is finished, the work shall stop until another person duly licensed for the doing of such work has been placed in charge thereof.

l. Violations. Whoever violates any provision of this section shall be punished by a fine of not more than $50.00 dollars, and, in addition, if the offender is licensed under this section, his license shall be revoked or suspended by the Superintendent, when so ordered by said board after a hearing.

Sec. 213. Penalties for violation of this code.

a. Violations. A building or structure which is erected or maintained in violation of any provision of this Code shall be deemed a common nuisance without other proof thereof than proof of the unlawful construction or maintenance, and the Superintendent may abate and remove it in the same manner in which boards of health may remove nuisances under sections one hundred and twenty-three to one hundred and twenty-five, inclusive, of chapter one hundred and eleven of the General Law.

b. Penalty. Except as otherwise provided in this Code, whoever violates any provision thereof, or whoever builds, alters, or maintains a structure or part thereof in violation of any provision thereof, after notification by the Superintendent, shall be punished by a fine of not exceeding one hundred dollars. Each day during any portion of which such violation is allowed to continue, or is permitted by the owner, shall be considered a separate offense.

PART III.

Definitions.

Sec. 301. Definitions.

a. General. Unless otherwise expressly stated, the following terms shall, for the purpose of this Code, have the meanings indicated in this section:

Abut. Touch, be contiguous. A building abuts upon a street when some part of the building touches or extends to the line of the street.

Alcove. A portion of an apartment separated from an adjoining room by a partition, with an opening between the two of 60% to 80% of the area of the separating partition and with no door to close such opening. If the opening is less than 60%, or if it is closed by a door or doors, the portion thus enclosed shall be considered as a separate room; if more than 80%, the portion thus enclosed shall be considered as a part of the room.

Alteration. Any change in the arrangement of a building, or any work affecting the structural parts of a building, or any change in walls, floors, partitions or means of exit, affecting the fire resistance or the safety of persons in the building.

Apartment. A room, or suite of two or more rooms, occupied or which is intended or designed to be occupied as a residence for one family.

Apartment Hotel. A building or a portion of which is occupied as the home or residence of families living independently of each other, but in which no cooking is done except in a common kitchen serving a common dining room, and having a common right in any corridors, stairs and exits.

Apartment House. A building arranged, intended or designed to be occupied by three or more families.

Approved. Where not otherwise specifically stated, the word "approved" shall mean approved by the Superintendent.

Area of a Building, Fire Division or Unit of Occupancy. The maximum horizontal area within the exterior walls of the building; or of the fire division walls; or unit of occupancy, respectively, including enclosed porches but excluding terraces, steps, cornices, fire escapes and exterior stairways or ramps.

Ashlar. Facing composed of solid rectangular units of burnt clay or shale, natural or manufactured stone, with sawed, dressed or squared beds, and joints laid in mortar and used in facing masonry walls.

Assembly Hall. A room, other than in a dwelling house, including the balconies thereof, if any, in which persons may assemble.

A. S. T. M. The American Society for Testing Materials.

Attic. The space, generally unfinished, above the ceiling of the top story of a building and below the roof, provided said space is not occupied by persons. An attic shall not be counted as a story.

Auditorium. An assembly hall in which persons may assemble for any purpose.

Automatic Sprinklers. A system of piping equipped with devices for releasing water under the influence of heat and spraying the water on ceilings, walls and floors.

Balcony. In an auditorium, a balcony, gallery or mezzanine; a floor inclined or level, above the main floor, not enclosed on one or more sides other than by a railing. Where a balcony of an auditorium has exits at two or more levels opening into separate foyers, one above the other, each portion thereof served by such a foyer shall be considered a separate balcony for the purpose of this Code.

Basement. A story, the floor of which is not less than 2′-0″ below and the ceiling of which is not less than 4′-6″ above finish grade.

Basement-Sub. Is one or more basements which are wholly underground and are directly below a basement or a cellar as herein defined.

Bearing Wall or Bearing Partition. See Walls.

Bay Window. A rectangular, curved or polygonal window extending beyond the main wall of the building.

Building. Any structure built for the support, shelter, or enclosure of persons, animals, chattels, or property of any kind.

Building, Existing. A building erected prior to the adoption of this Code, or one for which a legal building permit has been issued.

Building Height. The vertical distance of the highest point of the roof above the mean grade of the curbs of all the streets upon which it abuts, or if it does not abut on a street, above the mean grade of the ground adjoining the building.

Building, New. A building erected after the effective date of this Code and subject to the provisions thereof.

Cast Stone. A building stone manufactured from cement concrete pre-cast and used as a trim, veneer or facing on or in buildings or structures.

Cellar. A story or portion of a story having more than one-half of its clear height below the highest level of the adjoining ground.

Code, This Code. The Cambridge Building Code, comprising this ordinance and the regulations as established herein.

Corridor. An enclosed passageway.

Court. An open, uncovered and unoccupied space other than a yard on the same lot with the building.

Court, Inner. Any court other than an outer court, surrounded on four sides by walls.

Court, Outer. A court extending to an opening upon a street, alley or required yard.

Curb Level. The level of the established curb in front of a building measured at the middle of such front. Where no curb has been established, the City Engineer shall establish such curb level or its equivalent for the purposes of this Code.

Curtain Wall. See Walls.

Dead Load. In a building includes the weight of the walls, permanent partitions, framing, floors, roofs and all other permanent, stationary construction forming a part of the building.

Dwelling. Any house, building or portion thereof which is arranged, designed or intended to be occupied by one family or more.

Dwelling, Semi-Detached. A building arranged for occupancy by two families living side-by-side, vertically separated by a party wall. A semi-detached dwelling shall be considered as one main building occupying one lot for the purpose of determining yard requirements.

Dwelling, Multi-Family. A building arranged, intended or designed to be occupied by three or more families.

Dwelling, Single. A building arranged, intended or designed to be occupied by one family.

Dwelling, Two-Family. A building arranged, intended or designed to be occupied by two families, one living above the other.

Existing. Existing at the date of the passage of this ordinance.

Exit. A means of egress; a way out of a building or structure.

Exit from a Building. A doorway or other means of egress from the building opening upon a street or upon an open space with unobstructed access to the street.

Exit from a Room. A doorway or other means of egress from the room on the way toward an exit from the building.

Exit from a Story. A stairway, ramp, ladder or other means of egress from the story on the way toward an exit from the building.

Family. Any number of individuals living together as a single housekeeping unit.

Fire Districts. That territory or districts within the city limits, described in this Code, in which, with certain specified exceptions, the exterior walls shall be of 3 hour fire-protection.

Fire Division. A portion of a building so well separated from the rest by fire walls that it may be erected to the maximum height and area allowed for its principal occupancy and type of construction, independently of adjoining buildings or portions thereof. A portion of a building separated from the rest by fire walls.

Fire Door. A doorway construction consisting of door, frame and sill which under approved fire test conditions meets the requirement for the location in which it is to be used.

Fire Extinguisher. A portable device for extinguishing a fire.

Fire Partition. A wall or partition which subdivides a story of a building to restrict the spread of fire or to provide an area of refuge.

Fireproof Construction. As applied to buildings and structures, means that in which walls are of approved masonry, reinforced concrete or other incombustible material of not less than 4 hour fire-protection, and the structural members of which have fire-resistance ratings sufficient to withstand the hazard involved in the occupancy, but not less than indicated in table 1605 of this Code.

Fire Retardent Roof Covering. Any roof covering of brick, tile, slate, metal, asbestos shingles, asphalt shingles, composition of asbestos and asphalt, tar and gravel, or other approved material which has the inherent quality of not supporting combustion.

Fire Wall. A wall which subdivides a building or separates buildings to restrict the spread of fire, and which starts at the foundation and extends continuously through all stories to and above the roof.

First Aid Hose Station. A hose connection with valve in a system of piping adequately supplied with water, hose and nozzle for use of occupants of a building in extinguishing a fire.

Floor Area. Of a room, the area of the floor contained within the walls.

Foundation Wall. That part of a wall below the level of the curb, or, if a wall is not on a street, that part of the wall below the level of the highest ground next to the wall, or, if so construed by the Superintendent, that part of a party, fire or bearing wall below the cellar floor, or below the basement floor where there is no cellar.

Front. A building or wall fronts upon a street when a wall of the building or the wall faces the street and is parallel thereto or makes an angle of less than forty-five degrees therewith.

Frame Construction. As applied to buildings means that in which exterior walls are wholly or partly of wood.

Gallery. That portion of the seating space of an assembly room having a seating capacity of more than 10 located above a balcony.

Garage, Private. A building, or a portion of a building, in which only motor vehicles used by the tenants of the building or buildings on the premises are stored or kept only, and with space for not more than 3 pleasure automobiles.

Garage, Public. Means a garage not included within the term "private garage."

Grade (Finish). The final elevation at which the ground level shall be established.

Group Dwelling. A building arranged to provide, for rental purposes only, single-family accommodations, vertically separated, and not exceeding 6 in a row. The building shall occupy one lot in single ownership throughout and shall answer the lot area requirements per family.

Habitable Story. Any story that meets the requirements for light, air and sanitation, as herein described, for living purposes.

Half Story. Any story which is under a sloping roof, which has the point of intersection of the tops of the rafters and the face of the wall less than 3 feet above the floor level.

Heavy Timber Construction. As applied to buildings, means that in which walls are of brick, concrete, or reinforced-concrete; and in which the interior structural elements, including posts, floors, and roof construction, consist of heavy timbers with smooth, flat surfaces assembled to avoid thin sections, sharp projections and concealed or inaccessible spaces; and in which wall-supporting girders and structural members of steel or of reinforced-concrete, if used in lieu of timber construction, have a fire-resistance rating of not less than three hours.

NOTE: This type of construction is the same as that called "mill construction" for many years, and sometimes called "slow burning construction."

Height of Building. See Building Height.

Hereafter. After the time that this ordinance becomes effective.

Heretofore. Before the time that this ordinance becomes effective.

Hotel. An inn, the premises in which, under the statutes, meals and lodging must be provided for travelers at any hour of the day or night, and licensed by the local authorities as such.

Kitchen. A room used or adapted for cooking and containing a stove, range, hot-plate or other cooking apparatus, which burns coal, oil, gas or other fuel or is heated by electricity.

Lintel. A beam in a masonry wall supporting the masonry above an opening.

Live Load. The load or weight to be supported on a floor or other portions of a building incidental to its occupancy; the wind pressure, the weight of snow, and a load other than a dead load.

Lodging House. A house where lodgings are let to five or more persons not within the second degree of kindred to the person conducting it, and shall not include dormitories of charitable, educational or philanthropic institutions.

Masonry. Construction of assembled units of stone, brick, concrete, tile, gypsum or other similar incombustible materials separated from one another and held in place by mortar.

Masonry, Solid. Masonry built without hollow spaces.

Mezzanine Floor. A floor within a story between the floor and ceiling thereof, having an area not over forty per cent of the area of the building at the level at which the mezzanine floor occurs. A floor of larger area separates two stories.

Non-Bearing Wall or Non-Bearing Partition. One carrying no load except its own weight.

Occupancy. The purpose for which a building is used or intended to be used. Change of occupancy is not intended to include change of tenants or proprietors.

Owner. The owner of the land and premises as recorded in the Registry of Deeds for Middlesex County.

Partition. An interior wall supported at the floor or ceiling that serves to divide the space into rooms.

Party Wall. A masonry wall that separates two or more buildings and is used or adapted for the use of more than one building.

Passageway. A continuous way, of required width, kept clear for use as an exit, whether enclosed or not.

Penthouse. A structure above the roof of a structure or building, enclosing a stairway, tank, shaft, elevator machinery or ventilating apparatus and other accessories to the structure.

Pier. A vertical body of masonry used as a column, the portion of a masonry wall between thinner portions or between openings when the horizontal dimension parallel to the wall does not exceed four times the thickness.

Public Corridor. A hall, corridor or passageway in a multiple-dwelling but not within an apartment.

Repair. The replacement of existing work not including additional work that would affect the structural safety of the building, or that would affect or change required exit facilities, or that would affect a vital element of an elevator, plumbing, gas piping, wiring or heating installation, or that would be in violation of a provision of law or ordinance.

Schoolhouse. Any building or part of a building, used as a public or private school, academy, seminary or college, containing one or more rooms, where regular course of instruction is afforded to more than 10 pupils at one time.

Self-Closing. Normally closed and equipped with an approved device which will insure closing after having been opened for use.

Shaft. Whether for air, light, elevator, dumb-waiter or any other purpose, is an enclosed space within a building, extending through more than one floor.

Smoke Pipe. A flue, approximately horizontal, of metal or other material, in which smoke or the products of combustion are conducted from a furnace to a chimney or stack.

Smoke Stack. A vertical flue of metal, brick, masonry or reinforced concrete, whether or not lined with masonry or other protective material, in which smoke or the products of combustion are conducted upward for disposal in the open air at a height above the ground.

Story. That portion of a building comprised between the top of one floor to the top of the floor next above or the top of the roof. For all buildings other than Group H, I, J (residence) the maximum allowable story height of one story shall be 19 feet. The story height for Group H, I, J occupancy shall not be less than 8′-0″ measured from the finished floor to the finished ceiling of the same story.

Story, First. In all residence buildings of Group H and I occupancy the first story shall be the lowest habitable story above the basement or cellar.

For all other buildings the first story shall be that story in which the floor level is not lower than the level of the curb, or the mean elevation of the finished grade around the building if there is no curb.

Used. Where the word "used" is used, it shall be construed as if followed by the words "or is intended, arranged, designed, built, altered, converted, rented, or leased to be used."

Veneer. A facing of brick, stone, concrete, tile or similar material attached to a wall for the purpose of providing ornamentation, protection or insulation but not counted as adding strength to the wall.

Vertical Opening. An opening in a floor or roof for giving access vertically from the story below or above for light, ventilation, the movement of persons or materials or for any other purpose.

Wall, Non-Bearing. A wall which supports no load other than its own weight.

Wall, Panel or Curtain. A non-bearing wall in skeleton construction built between columns or piers and wholly supported at each story.

Wall, Parapet. That part of any wall entirely above the roof line.

Wall, Retaining. Any wall used to resist the lateral displacement of any material.

PART IV.

Fire District.

§ 401. Fire district.
§ 402. Boundaries.
§ 403. Limitations within fire districts.
§ 404. Roof covering.

Sec. 401. Fire district.

There is hereby established in the City of Cambridge a fire district within which buildings and structures shall be erected as provided in this part. Outside the fire district no limitations are placed by this part on buildings and structures.

Sec. 402. Boundaries.

a. North of Massachusetts Avenue. Starting at a point 100 ft. north of Massachusetts Avenue on the Arlington-Cambridge City line, thence, in a general direction, easterly and parallel to Massachusetts Avenue to a point 100 ft. north of the intersection point of Peabody St. and Massachusetts Avenue; thence easterly and perpendicular to Peabody St. to a point 100 ft. east of Peabody St.; thence southerly and parallel to Peabody St. to a point 100 ft. north of Massachusetts Avenue; thence easterly and parallel to Massachusetts Avenue to a point 100 ft. east of Quincy St.; thence southerly and parallel to Quincy St. and as extended to a point 100 ft. north of Massachusetts Avenue; thence easterly and parallel to Massachusetts Avenue to the centerline of Inman St.; thence northerly following the centerline of Inman St. to the centerline of Austin St.; thence easterly following the centerline of Austin St. to the centerline of School St.; thence easterly following the centerline of School St. to the centerline of Windsor St.; thence northerly following the centerline of Windsor St. to the centerline of Harvard St.; thence easterly following the centerline of Harvard St. to the centerline of Clark St.; thence northeasterly following the centerline of Clark St. to the centerline of Hampshire St.; thence southeasterly following the centerline of Hampshire St. to the centerline of Portland St.; thence northeasterly following the centerline of Portland St. to the centerline of York St.; thence easterly and at right angles to Portland St. to the centerline of Ninth St.; thence southerly following the centerline of Ninth St. to the centerline of Bent St.; thence easterly following the centerline of Bent St. to the centerline of Third St.; thence northeasterly following the centerline of Third St. to the centerline of Spring St.; thence westerly following the centerline of Spring St. to a point 100 ft. west of the westerly line of Third St.; thence northerly and parallel to Third St. to a point 100 ft. south of the southerly line of Cambridge St.; thence westerly and parallel to Cambridge St. to a point 100 ft. east of the easterly line of Fayette St.; thence northerly and at right angle to Cambridge St. to the Somerville line; thence easterly along the Somerville line to the center of Springfield St.; thence southerly through the centerline of Springfield St. to a point 100 ft. north of Cambridge St.; thence easterly and parallel to Cambridge St. to the centerline of Third St.; thence northerly through the centerline of Third St. to the centerline of Bridge St.; thence easterly along the centerline of Bridge St. to the shore line of Charles River.

b. South of Massachusetts Avenue. Starting at a point located 100 ft. south of the southerly line of Massachusetts Avenue on the Arlington-Cambridge City line, thence, in a general direction, easterly and parallel to Massachusetts Avenue to the junction of the extension of the centerline of Follen St.; thence westerly and southerly following the extension and centerline of Follen St. to the centerline of Waterhouse St.; thence easterly through the centerline of Waterhouse St. to a point 100 ft. distant west from the westerly line of Massachusetts Avenue; thence southerly along Massachusetts Avenue, to the centerline of Church St.; thence westerly following the centerline of Church St. to the centerline of Brattle St.; thence northerly following the centerline of Brattle St. to the centerline of Story St.; thence southwesterly following the centerline of Story St. to a point 100 ft. west of the westerly line of Brattle St.; thence southerly and parallel to Brattle St. to the centerline of Mifflin Place; thence southwesterly following the centerline of Mifflin Place to the centerline of Mt. Auburn St.; thence westerly following the centerline of Mt. Auburn St. to the centerline of University

Rd.; thence southwesterly following the centerline of University Rd. and University Rd. extension to the shore line of Charles River; thence southerly and easterly following the shore line of Charles River to the extension of the centerline of De Wolfe St.; thence northerly following the centerline of De Wolfe St. extension and De Wolfe St. to a point 100 ft. south of the southerly line of Mt. Auburn St.; thence easterly and parallel to Mt. Auburn St. to a point intersecting with a line 100 ft. south of the southerly line of Massachusetts Avenue; thence easterly and parallel to Massachusetts Avenue to the centerline of Pleasant St.; thence southerly following the centerline of Pleasant St. to the centerline of Auburn St.; thence southeasterly following the centerline of Auburn St. to the centerline of Brookline St.; thence southerly following the centerline of Brookline St. to the centerline of Emily St.; thence easterly through the centerline of Emily St. to a point 100 ft. east of the easterly side of Brookline St.; thence southerly and parallel to Brookline St. to the centerline of Henry St.; thence westerly through the centerline of Henry St. to the centerline of Brookline St.; thence southerly through the centerline of Brookline St. to the shore of Charles River; thence easterly and northeasterly following the shore line of Charles River to the center line of Bridge St., at the point of beginning.

c. Area within Boundary. The area within the boundary lines of the fire district constitutes the mercantile and business sections along Massachusetts Avenue, Harvard Square, Central Square, a portion of Cambridge St. and the greater part of the eastern end of Cambridge along the Charles River.

Sec. 403. Limitations within fire districts.

a. General. Unless hereinafter excepted in this section all buildings and structures hereinafter erected within the fire district shall have exterior walls built of brick, stone, concrete or similar incombustible material and roofs covered with fire-retardant roofing, see Section 3705, b. This means that no building or structure of type 5 and type 6 construction shall be erected within the fire district except the following:

b. Exceptions. (1) Builders' shanties not more than one story in height, for use only in connection with a duly authorized building operation and located on the same lot with such building operation, on a lot immediately adjoining, on an upper floor of the building under construction, or on a sidewalk shed.

(2) Wood fences not exceeding six feet in height.

(3) A building of type 5 or type 6 construction within such a district and damaged by fire or other casualty to the extent of not more than 50 per cent of its assessed value, may be repaired or restored so as to conform to its original condition, if the prevention of fire and the preservation of life are thereby reasonably secured. Otherwise, such damaged building shall be reconstructed so as to conform to the provisions of this Code for new buildings.

c. Moving Buildings. No building of type 5 or type 6 construction shall hereafter be moved from without to within the fire district, and no building of type 5 or type 6 construction shall be moved away from the lot upon which it is built or to any position where the fire hazard would be increased.

d. Alterations. Within the fire district no building or structure of type 5 or type 6 construction shall be hereafter increased in height or area unless the entire structure is made to conform with the provisions of this Code.

Sec. 404. Roof covering.

a. Within Fire District. Roof covering within the fire district shall be fire retardant roofing as specified in Section 3705, b.

b. Outside Fire District. Roof covering outside the fire district may be ordinary roofing as specified in Section 3705, c.

PART V.

Classification by Occupancy.

§ 501. State regulations.
§ 502. General classifications.
§ 503. Buildings not covered under section 502.
§ 504. Change in occupancy.
§ 505. Fire walls between maximum floor areas.
§ 506. Fire separation required for mixed occupancy.
§ 507. Zoning regulations.
§ 508. General.

GENERAL PROVISIONS.

Sec. 501. State regulations.

The laws and regulations of the Massachusetts Department of Public Safety with respect to the use and occupancy of buildings, outlined in Section 207, b, shall not be deemed to be modified by any provisions of this Code; and such restrictions shall be controlling, except in so far as this Code imposes greater restrictions, in which case the latter shall control.

Sec. 502. General classifications.

For the purpose of this Code, every building shall be classified according to its use or occupancy, in the following groups:

Refer to Part	*Group*	
6	Group A.	Theatres, Large Assembly Halls
7	Group B.	Churches, Halls
8	Group C.	Schools
9	Group D.	Hospitals and Detention Buildings
10	Group E.	Commercial Buildings, Hazardous
11	Group F.	Office and Commercial Buildings
12	Group G.	Commercial Buildings, Non Hazardous
13	Group H.	Dwellings, Large
14	Group I.	Dwellings, Small
15	Group J.	Miscellaneous Structures

Sec. 503. Buildings not covered under section 502.

Any occupancy or use not covered specifically under Section 502, or about which there is any question, shall be classified by the Superintendent and assigned in the group which its use most nearly resembles in regard to fire hazard and danger to life.

Sec. 504. Change in occupancy.

The change of occupancy or use of a building shall conform to the provisions of Section 209.

Sec. 505. Fire walls between maximum floor areas.

1. Fire walls separating the maximum floor area of a building, given in the tables of Parts VI to XV inclusive, shall conform with the provisions of Section 2413.

2. The aggregate openings in fire walls on any one floor in buildings of Group A, B, C, D, E, F, G, H, I, and J occupancy shall not exceed 33 1/3 per cent of the wall area, and no single opening shall exceed 150 square feet. All openings in fire walls and fire separa-

tions shall be protected by two approved fire doors, separated by the thickness of the wall, one of the doors to be automatic closing.

3. Party walls which function also as fire walls, shall conform to the requirements for fire walls.

Sec. 506. Fire separation required for mixed occupancy.

When a building is used for two or more groups of occupancy the whole building shall be constructed to conform with the provisions of that group requiring the greatest fire resistance unless the parts used for the several groups of occupancy are separated from one another by fire separations having a fire resistance specified under Parts VI to XV inclusive.

Sec. 507. Zoning regulations.

All provisions of the zoning ordinance are to be followed in conjunction with the provisions of this Code.

Sec. 508. General.

The types of construction referred to this Code are defined in Parts 16 to 22 inclusive. For Miscellaneous Regulations pertaining to the construction and special occupancy of buildings refer to Part XLV.

PART VI.

Requirements Based on Occupancy.

§ 601. Group A occupancy defined.
§ 602. Separation of occupancies.
§ 603. Type of construction, area, height.
§ 604. Exterior walls.
§ 605. Dressing rooms.
§ 606. Enclosure of vertical openings.
§ 607. Ceiling of basement and cellar.
§ 608. Exits.

GROUP A. THEATRES, LARGE ASSEMBLY HALLS.

Sec. 601. Group A occupancy defined.

1. Group A occupancies shall include buildings or parts of buildings used for public assembly, other than Group B, where 400 or more persons may congregate in any one room or enclosure such as:

2. Theatres and public assembly halls having a scenery loft and a stage; motion picture theatres; public assembly halls having no scenery loft; opera houses and music halls. See Part V for general provisions.

Sec. 602. Separation of occupancies.

Group A occupancies shall be separated from other occupancies in the same building by walls having a fire resistance of at least three hours, and by floors having a fire resistance of at least two and one-half hours. Openings in such walls shall conform with the provisions of Section 505, 2.

Sec. 603. Type of construction, area, height.

a. General. All buildings or parts thereof in Group A occupancy shall comply with the following table, with regard to type of construction, floor area and height of building.

TABLE 603.

Type of Construction	Max. Height	Allowable Floor Area of Building or between Fire Walls No. of Streets on Which Building Fronts		
		1	2	3 or more
1	Not hereby limited*	No limit	No limit	No limit
2	75 ft.	5,000 sq. ft.	6,000 sq. ft.	7,000 sq. ft.

*See Zoning Ordinance.

NOTE: The maximum floor area provided in this section for buildings of type 2 construction, may be increased 50 per cent if the entire basement area and storage and property rooms and other rooms of similar use is protected by automatic sprinklers.

b. Exceptions. 1. The portion of the stage floor used in the working of scenery traps or other mechanical apparatus to be at least of type 3 construction, and steel beams need not be protected against fire. This construction shall not extend beyond the proscenium wall or the proscenium curtain, and shall not exceed the width of the proscenium opening by more than three feet on each side. All other portions of the stage shall be of type 1 or type 2 construction. The area under a stage of other than type 1 and type 2 construction shall not be used for storage or for any purpose other than the working of traps and mechanical apparatus necessary for a performance on the stage.

2. *Gridirons and Fly Galleries.* Gridirons and fly galleries shall be constructed of incombustible materials, and fireproofing of metal shall not be required, and shall not be less than 5′-0″ above the proscenium arch.

3. *Hood Over Switchboard.* If the switchboard is located on the stage floor a protecting hood of incombustible material shall be provided over and the full length of the stage switchboard. The switchboard shall be protected on the sides and back by a grille of three-sixteenths inch wire with not more than two-inch mesh, or by partitions of incombustible materials having a one-hour fire-resistive rating, and on the front by a railing not less than three feet high.

Sec. 604. Exterior walls.

1. Exterior walls or parts of walls in buildings of Group A occupancy, except where fronting on a street, which are less than five feet from a property line, shall be without openings, except that openings in such walls at the ends of courts shall be allowed when protected by Class B fire doors or fire windows. Openings in such walls or parts of walls which are five feet or more but less than ten feet from a property line shall be protected by Class B fire doors or fire windows.

2. In an exterior wall, every opening which faces, at a distance of less than twenty feet horizontally, the further side of a street or a combustible wall or roof or an unprotected opening in a wall or roof of another building, shall be protected by Class B fire doors or fire windows.

Sec. 605. Dressing rooms.

The dressing rooms and other rooms shall have at least one exit besides that to the stage, and shall be separated from the stage by a two-hour fire wall, and automatic-closing Class B fire doors. All shelving and closets in dressing rooms, property rooms and storage rooms shall be constructed of incombustible materials.

Sec. 606. Enclosure of vertical openings.

In buildings of Group A occupancy the enclosure of vertical openings shall conform with the provisions of Part XXX.

Sec. 607. Ceiling of basement and cellar.

The entire ceiling of basement or cellar shall be at least of 1 hr. fire-resistive construction.

Sec. 608. Exits.

Exits for buildings of Group A occupancy shall conform with the provisions of the Massachusetts Department of Public Safety.

PART VII.

Requirements Based on Occupancy.

§ 701. Group B occupancy defined.
§ 702. Separation of occupancies.
§ 703. Type of construction, area, height.
§ 704. Exterior walls.
§ 705. Stage construction.
§ 706. Dressing, boiler and storage rooms.
§ 707. Enclosure of vertical openings.
§ 708. Ceiling of basement and cellar.
§ 709. General.

GROUP B. CHURCHES AND HALLS.

Sec. 701. Group B occupancy defined.

Group B occupancies shall include places of assembly, not included in Group A, such as churches, gymnasiums, and dance halls. Also other assembly halls with a stage and with an auditorium seating less than 400 persons.

Sec. 702. Separation of occupancies.

Group B occupancies shall be separated from other occupancies in the same building by walls having a fire-resistance of at least three hours, and by floors having a fire-resistance of at least one and one-half hours. Openings in such walls shall conform with the provisions of Section 505, 2.

Sec. 703. Type of construction, area, height.

a. General. All buildings or parts thereof in Group B occupancy shall comply with the following table, with regard to type of construction, floor area and height of building.

TABLE 703.

Type of Const.	Max. Height	No. of Stories	Allowable Floor Area of Buildings or between Fire Walls
1	Not hereby limited*		No limit
2	55	4	18,000
		3	7,500
		1	24,000
3	45	2	10,000
		1	15,000
4	35	2	15,000
		1	18,000
6	35	1	5,000

*See Zoning Ordinance.

NOTE: The maximum area provided in this section may be increased 50 per cent if the entire floor area except ways of egress is protected by automatic sprinklers. The first floor of buildings of Group B occupancy, more than two stories in height shall be of Type I construction.

Sec. 704. Exterior walls.

1. Exterior walls which are less than five feet from a property line shall be of 4 hrs. fire-resistive construction without openings, except that openings in such walls at the ends of courts shall be allowed when protected by Class B fire doors or fire windows. Such walls or parts of walls which are 5 feet or more, but less than 10 feet from a property line shall be of at least 3 hours fire-resistive construction and all openings therein shall be protected by Class B fire doors or fire windows.

2. Every portion of an exterior wall which faces, at a horizontal distance of less than 20 ft., the further side of a street, or a combustible wall or roof or an unprotected opening in a wall or roof of another building shall be at least of 3 hrs. fire-resistive construction, all openings therein shall be protected with Class B fire doors or fire windows.

Sec. 705. Stage construction.

Where a stage or platform is without provisions for scenery, the stage floor or platform may be of the same type of construction as the auditorium floor, or it may be constructed of wood, if the auditorium floor extends under the full area of such stage or platform.

Sec. 706. Dressing, boiler and storage rooms.

a. Dressing Rooms. The dressing rooms when provided shall have access to at least one exit besides that to the stage or platform, and there shall be a 2-hour fire-resistive protection between the stage or platform and dressing rooms.

b. Boiler Room. The floor, walls and ceiling of boiler and fuel rooms shall be of two-hour fire-resistive construction. Doors and windows shall be Class B, automatic closing.

c. Storage Rooms. Storage rooms shall not be placed under the stage unless such rooms are surrounded with 2-hour fire-resistive walls and ceiling.

Sec. 707. Enclosure of vertical openings.

The enclosure of vertical openings in buildings of Group B occupancy shall conform with the provisions of Part XXX.

Sec. 708. Ceiling of basement and cellar.

The entire ceiling of basement or cellar shall be at least of one hour fire-resistive construction.

Sec. 709. General.

The exits, lights, ventilation, aisles and other pertinent items shall be in accordance with the regulations of the Massachusetts Department of Public Safety.

PART VIII.

Requirements Based on Occupancy.

§ 801. Group C occupancy defined.
§ 802. Separation of occupancies.
§ 803. Type of construction, area, height.
§ 804. Exterior walls.
§ 805. Enclosure of vertical openings.
§ 806. Boiler, storage and fuel rooms.
§ 807. Ceiling of basement.
§ 808. General.

GROUP C. SCHOOLS.

Sec. 801. Group C occupancy defined.

Group C occupancy shall include every building used wholly or in part as a private or public school, college, academy and seminary.

Sec. 802. Separation of occupancies.

Group C occupancies shall be separated from other occupancies in the same building by walls having a fire resistance of at least 3 hours and by floors having a fire resistance of 2½ hours. Opening in such walls shall conform with the provisions of Section 505, 2. See Part V for general provisions.

Sec. 803. Type of construction, area, height.

All buildings or parts thereof in Group C occupancy shall comply with the following table, with regard to type of construction, floor area and height of building.

TABLE 803.

Type of Const.	Max. Height	No. of Stories	Allowable Floor Area of Building or between Fire Walls
1	Not hereby limited*		No limit
2	75	5	20,000
		1	24,000
3	35	2	17,000
		1	20,000
4	35	2	12,000
		1	18,000
6	35	1	5,000

*See Zoning Ordinance.

NOTE: The maximum area provided in this section may be increased 50 per cent if the entire floor area except ways of egress is protected by automatic sprinklers.

Sec. 804. Exterior walls.

1. Exterior walls or parts of walls, except where fronting on a street, which are less than five feet from a property line, shall be of four-hour fire-resistive construction, without openings. Such walls or parts of walls which are five feet or more, but less than ten feet from a property line, shall be of at least two-hour fire-resistive construction and all openings therein shall be protected by Class B fire doors or fire windows.

2. Every portion of an exterior wall which faces, at a distance of less than twenty feet, the further side of a street, or a combustible wall or roof, or an unprotected opening in a wall or roof of another building on the same lot, shall be of at least two-hour fire-resistive construction, and all openings in such portions shall be protected by Class B fire doors or fire windows.

Sec. 805. Enclosure of vertical openings.

The enclosure of vertical openings in buildings of Group C occupancy shall conform with Part XXX.

Sec. 806. Boiler, storage and fuel rooms.

Boiler, fuel and storage rooms for buildings of Group C occupancy shall have such enclosures as directed by the Superintendent, and openings in such walls shall be provided with self-closing Class B fire doors. The floors of boiler and fuel rooms shall be of concrete or other approved materials.

Sec. 807. Ceiling of basement.

The entire ceiling of basement in buildings of Group C occupancy shall be constructed of at least 1-hour fire-resistive construction.

Sec. 808. General.

The exits, lighting, heating, ventilation and other provisions shall be in accordance with the provisions of Chapter 143 of the General Laws, and any amendment thereto, as enforced by the Department of Public Safety. In such buildings not covered by this section, the Superintendent shall make regulations governing the exits, lighting, heating, and ventilation.

PART IX.

Requirements Based on Occupancy.

§ 901. Group D occupancy defined.
§ 902. Separation of occupancies and fire protection.
§ 903. Type of construction, area, height.
§ 904. Exterior walls.
§ 905. Enclosure of vertical openings.
§ 906. Fire extinguishing apparatus.
§ 907. Special requirements.
§ 908. General.

GROUP D. HOSPITALS AND DETENTION BUILDINGS.

Sec. 901. Group D occupancy defined.

Group D occupancy shall be separated into two divisions, and include the following.

Division 1. Jails, prisons, reformatories, houses of correction, asylums for the insane or feeble-minded.

Division 2. Hospitals, sanitariums, orphanages, nurseries, homes for the aged and similar buildings with sleeping accommodations for ten or more persons.

Sec. 902. Separation of occupancies and fire protection.

1. Buildings of Group D 1 occupancy shall be of type 1 construction throughout. Walls separating D 1 occupancy from other occupancy in the same building shall be of 4-hour fire-resistive construction. Openings in such walls shall conform with the provisions of Section 505, 2.

2. Buildings of Group D 2 occupancies shall be separated from other occupancies in the same building by walls having a fire resistance of at least 3 hours. Ceilings and partitions in buildings more than one story in height shall be of not less than one-hour fire-resistive construction, and the first floor of such buildings more than two stories in height shall be of type 1 construction. The basement ceiling shall have a minimum of 1-hour fire-resistive construction. Openings in fire walls shall conform with the provisions of Section 505, 2. See Part V for general provisions.

Sec. 903. Type of construction, area, height.

All buildings, or parts thereof, of Group D occupancies shall comply with the following table, with regard to type of construction, floor area and height of building, except as modified by Section 902.

TABLE 903.

Type of Const.	Max. Height	No. of Stories	Allowable Floor Area of Building or between Fire Walls
1	Not hereby limited*		No limit
2	75	5	17,000
		1	20,000
3	45	3	12,000
	35	1	18,000
4	45	3	10,000
	35	1	15,000
6	35	1	2,500

*See Zoning Ordinance.

Sec. 904. Exterior walls.

1. Exterior walls or parts of walls, except where fronting on a street, which are less than 5 feet from a property line, shall be of 4-hour fire-resistive construction without openings, except that openings in such walls at the ends of courts shall be allowed when protected by Class B fire doors or fire windows. Such walls or parts of walls which are five feet or more, but less than 10 ft. from a property line shall be of at least 3-hour fire-resistive construction and all openings therein shall be protected by Class B fire doors or fire windows.

2. Every portion of an exterior wall which faces, at a horizontal distance of less than 20 ft., the further side of a street, or a combustible wall or roof, or an unprotected opening in a wall or roof of another building shall be of at least 3-hour fire-resistive construction, and all openings in such portions shall be protected by Class B fire doors and fire windows.

Sec. 905. Enclosure of vertical openings.

The enclosure of vertical openings in buildings of Group D occupancy shall conform with the provisions of Part XXX.

Sec. 906. Fire extinguishing apparatus.

1. All cellars, basements and shafts shall be protected by automatic sprinklers, as directed by the Superintendent. Store rooms,

kitchen, utility rooms and other rooms in buildings of other than type I or type II construction shall be protected by automatic sprinklers, as directed by the Superintendent.

2. In all buildings either portable fire extinguishers, not less than one for every twenty-five hundred square feet of floor area and at least one in each story, and basement, or first aid standpipes shall be provided.

3. Fire department standpipes and first aid standpipes shall be provided in buildings more than seventy feet high.

Sec. 907. Special requirements.

1. Every gas service shall have a shut-off easily accessible from the outside and conspicuously marked.

2. Every boiler room or room containing heating apparatus shall be separated from the rest of the building with a three-hour firewall and 2½ hour fire-resistive ceiling.

Sec. 908. General.

The exits, light, ventilation, and other provisions shall be in accordance with the regulations of the Massachusetts Department of Public Safety.

PART X.

Requirements Based on Occupancy.

§ 1001. Group E occupancy defined.
§ 1002. Separation of occupancies.
§ 1003. Type of construction, area, height.
§ 1004. Exterior walls.
§ 1005. Enclosure of vertical openings.
§ 1006. Fire extinguishing apparatus.
§ 1007. Special hazards in buildings of Groups E-2 and E-3 occupancy.
§ 1008. Light and ventilation.
§ 1009. Exits.

GROUP E. COMMERCIAL BUILDINGS OF HAZARDOUS OCCUPANCY.

Sec. 1001. Group E occupancy defined.

Group E occupancies shall be separated into 3 divisions, and include the following:

Division E-1. Garages of four or more car capacity, freight depots where trucks are permitted to enter, and hangars.

Division E-2. Planing mills, box factories, wood working plants, mattress factories, paint shops, and dry cleaning plants.

Division E-3. Buildings for the storage of hazardous, highly inflammable or explosive material or liquids, such as public gasoline service stations, manufacture or storage of varnishes, lacquers, celluloid and like products.

Sec. 1002. Separation of occupancies.

1. Group E-1 occupancy shall be separated from other occupancies in the same building by walls having a fire resistance of at least 4 hours and by floors having a fire resistance of 2½ hours.

2. Group E-2 and E-3 occupancies shall be separated from other occupancies in the same building, by walls having a fire resistance of at least 3 hours and by floors having a fire resistance of at least 1½ hours.

3. The aggregate openings in such walls shall conform to the provisions of Section 505, 2, except that openings shall not be permitted between Group E occupancy and Groups A, B, C and D occupancies. See Part V for general provisions.

Sec. 1003. Type of construction, area, height.

All buildings or parts thereof in Group E occupancy shall comply with the following table, with regard to type of construction, floor area and height.

TABLE 1003.

Type of Const.	Max. Height (Feet)	Max. No. Stories	Maximum Floor Area of Building or between Fire Walls			
			Within fire district See Part 4	Outside fire district		
				No. of streets on which building fronts		
				1	2	3 or more
1	Not hereby limited*		Not hereby limited, sprinkler and sprinkler alarm if over 10,000 sq. ft.			
2	50	4	8,000	8,000	10,000	12,000
3	35	1	5,000	8,000	10,000	12,000
4	35	1	5,000	7,500	8,500	10,000

*See Zoning Ordinance.

NOTE 1: In addition to the above requirements, buildings or parts of buildings of Group E-1 occupancy shall conform to the provisions of the Massachusetts Department of Public Safety.

NOTE 2: The entire ceiling of basement or cellar in buildings of Group E occupancy shall be at least one hour fire-resistive construction.

Sec. 1004. Exterior walls.

1. Exterior walls or parts of walls, except where fronting on a street, which are less than 5 feet from a property line, shall be of 4 hour fire-resistive construction without openings, except that openings in such walls at the ends of courts shall be allowed when protected by Class B fire doors or fire windows. Such walls or parts of walls which are 5 feet or more, but less than 10 feet from a property line, shall be of at least 3 hour fire-resistive construction and all openings therein shall be protected by Class B fire doors or fire windows.

2. Every portion of an exterior wall which faces, at a distance of less than 20 feet, the further side of a street, or a combustible wall or roof, or an unprotected opening in a wall or roof of another building on the same lot, shall be of at least 3 hour fire-resistive construction, and all openings in such portions shall be protected by Class B fire doors or fire windows.

Sec. 1005. Enclosure of vertical openings.

The enclosure of vertical openings for buildings of Group E occupancy shall conform with the provisions of Part XXX.

Sec. 1006. Fire extinguishing apparatus.

a. Buildings of Group E-1 Occupancy. Fire extinguishing apparatus in buildings of Group E-1 occupancy shall conform to the provisions of the Massachusetts Department of Public Safety.

b. Buildings of Group E-2 and E-3 Occupancy. 1. Automatic sprinklers shall be provided in buildings of Group E-2 and E-3 occupancy in the following locations.

2. In cellars and basements of which the floor area is more than 5000 sq. ft.

3. Throughout the entire floor area within the fire walls which is occupied wholly or in part as a planing mill, box factory, or other wood working establishment, in which more than two power-operated wood working machines, other than saws, are used.

4. Throughout the entire floor area within the fire walls which is occupied wholly or in part as a mattress factory or used to manufacture, assemble or renovate mattresses or stuffed furniture using cotton, silk floss, mohair or other like material for packing or stuffing.

5. In a building used as a film exchange, or for the manufacture or storage of nitro-cellulose pyroxylin products.

6. Portable fire extinguishers, not less than one for every 2000 sq. ft., or fraction thereof, of floor area in buildings or portions of a building of Groups E-2 and E-3 occupancy, and at least one for every story and basement.

7. Fire department standpipes and first aid standpipes shall be provided in every building more than seventy feet high.

Sec. 1007. Special hazards in buildings of Groups E-2 and E-3 occupancy.

1. Neither apparatus having an open flame nor a heater with an enclosed flame shall be installed or operated in a dry cleaning establishment or place where volatile flammable liquids are used or stored, unless approved by the state fire marshal.

2. Rooms in which volatile flammable liquids are used or stored shall be enclosed with partitions of not less than one-hour fire-resistive construction. Doorways in such partitions shall have Class C fire doors so equipped as to close automatically in case of fire. Rooms in which paint, petroleum or other flammable liquids are used or stored otherwise than in unopened containers shall have non-absorbent, incombustible floor finish.

3. The underside of the roof construction or ceilings of buildings, over 1000 square feet in floor area, of type 3 or type 4 construction shall be one-hour fire-resistive construction, if less than 12′-0″ above finished floor.

4. Any skylight in the roof of a building within 20 feet of a lot line or building of a greater height shall be of metal frame and wire glass.

5. An existing building or other structure hereafter converted for use as a building of Group E-2 or E-3 occupancy, and an addition or alteration to an existing building shall conform to the requirements of this Code for a new building erected at the same location.

6. In buildings of type 3 and 4 construction that have areas of more than 1000 square feet, all dividing partitions shall be incom-

bustible or 1 hour fire protected on both sides; but in buildings of type 1 or 2 construction such partitions shall be of incombustible material; except that wood may be used inside of an office for non-bearing partitions and flooring, and for doors and windows except as otherwise provided.

7. In a dry cleaning establishment each machine which uses a volatile flammable liquid shall have an adequate steam line directly connected to it, so arranged as automatically to fill the machine with steam in case of fire or explosion therein.

8. No system of heating other than steam or hot water shall be permitted unless approved by the State Fire Marshal. A steam or hot water heater shall be located in a room separated from the remainder of the building by 2 hour partitions with all openings therein protected by Class B fire doors or fire windows.

Sec. 1008. Light and ventilation.

1. The light and ventilation in buildings of Group E-1 occupancy shall be made to comply with the provisions of the Massachusetts Department of Public Safety.

2. All rooms in buildings of E-2 and E-3 occupancy that are generally used or occupied by human beings shall be provided with light and ventilation by means of windows or skylights with an area equal to ⅛ of the floor area, or shall be provided with artificial light and a mechanically operated ventilating system which shall supply 12 cu. ft. of air per minute per person or a complete change of air per hour, whichever is greater. Such system shall be continuously in operation while the building is occupied.

3. No artificial lighting other than incandescent electric lights shall be installed or used in buildings of E-2 and E-3 occupancy, and such light shall be fitted with keyless sockets. All electric switches and plugs shall be placed at least four feet above the floor. All portable lights shall be equipped with handles, hooks, lamp guards, and shall have keyless sockets.

Sec. 1009. Exits.

1. Exits from buildings of E-1 occupancy shall conform to the provisions of the Massachusetts Department of Public Safety.

2. The exits from buildings of Group E-2 and E-3 occupancy shall conform with the provisions of Part 33.

PART XI.

Requirements Based on Occupancy.

§ 1101. Group F occupancy defined.
§ 1102. Separation of occupancies.
§ 1103. Type of construction, area, height.
§ 1104. Exterior walls.
§ 1105. Enclosure of vertical openings.
§ 1106. Fire extinguishing apparatus.
§ 1107. Light and ventilation.
§ 1108. Exits.
§ 1109. Sanitation.

GROUP F. OFFICE AND COMMERCIAL BUILDINGS.

Sec. 1101. Group F occupancy defined.

Group F occupancies shall include office building, restaurants, police stations and fire stations, museums, libraries, wholesale and retail stores, printing plants, factories and work shops using materials not highly flammable, buildings for the storage of goods not highly flammable, stables and other similar buildings.

Sec. 1102. Separation of occupancies.

1. Group F occupancies shall be separated from other occupancies in the same building by walls and floors having a fire-resistive construction of at least 1 hour, except that separations between Group F and Group G 1 occupancy shall be a three hour wall.

2. The aggregate openings in such walls on any one floor shall not exceed 100 sq. ft. and every such opening shall be protected by 1 Class C self-closing fire door and fire windows, except that openings in such walls between Group F and G 1 occupancies shall be protected by 2 self-closing Class B fire doors, separated by the thickness of the wall. See Part V for general provisions.

Sec. 1103. Type of construction, area, height.

All buildings or parts thereof in Group F occupancy shall comply with the following table with regard to type of construction, floor area and height.

Type of Const.	Height in feet	Maximum floor area of building or between fire walls		
		No. of streets on which building fronts		
		1	2	3 or more
1	not hereby limited*	Not hereby limited		
2	75	18,000	20,000	25,000
3	65	9,000	10,000	12,000
4	50	6,000	7,500	10,000
5	see note 1			
6	35	5,000	6,500	3,000

*See Zoning Ordinance.

NOTE 1: Buildings of Group F occupancy, used for storage only, may be of type 5 construction if they are one story in height and do not exceed in area, 5,000 sq. ft. when fronting on one street, 6,000 sq. ft. in area fronting on two streets and 7,000 sq. ft. in area fronting on three or more streets.

NOTE 2: The maximum floor area provided in this section for buildings of Group F occupancy less than 6 stories in height, may be increased 50 per cent if the entire floor area, except ways of egress, is protected with automatic sprinklers.

NOTE 3: The entire ceiling of basements and cellars in buildings of Group F occupancies shall be at least of one hour fire-resistive construction.

Sec. 1104. Exterior walls.

1. Exterior walls or parts of walls, except where fronting on a street, which are less than ten feet from a property line, shall be of at least two-hour fire-resistive construction and all openings therein shall be protected by Class B fire doors or fire windows.

2. Every portion of an exterior wall which faces, at a distance of less than twenty feet, the further side of a street, or a combustible wall or roof, or an unprotected opening in a wall or roof of another building on the same lot, shall be of at least two-hour fire-resistive construction, and all openings in such portions, except doorways and windows in the first story fronting on a public way, shall be protected by Class B fire doors or fire windows.

3. In buildings of Type 5 construction exterior walls of unpro-

tected metal may be considered to meet the requirements of this section for two-hour walls.

Sec. 1105. Enclosure of vertical openings.

The enclosure of vertical openings in buildings of Group F occupancy shall conform with the provisions of Part XXX.

Sec. 1106. Fire extinguishing apparatus.

1. Automatic sprinklers shall be installed in cellars and basements of which the floor area is more than 7,500 sq. ft.
2. Buildings of Group F occupancies, six or more stories in height shall be equipped throughout with automatic sprinklers.
3. There shall be, in buildings of Group F occupancy, not less than one approved portable fire extinguisher for every 5,000 sq. ft. of floor area and not less than one in each story and basement.
4. Fire department standpipes and first aid standpipes shall be provided in buildings more than 75 ft. high.

Sec. 1107. Light and ventilation.

Rooms used by human beings shall be provided with light and ventilation by means of windows or skylights with an area at least one eighth of the floor area or shall be provided with artificial light and a mechanically operated ventilating system which will meet with the approval of the Superintendent.

Sec. 1108. Exits.

The exits in buildings of Group F occupancy shall conform to the provisions of Part 33.

Sec. 1109. Sanitation.

Refer to Section 4511.

PART XII.

Requirements Based on Occupancy.

§ 1201. Group G occupancy defined.
§ 1202. Separation of occupancies.
§ 1203. Type of construction, area, height.
§ 1204. Exterior walls.
§ 1205, Enclosure of vertical openings.
§ 1206. Fire extinguishing apparatus.
§ 1207. Light and ventilation.
§ 1208. Sanitation.

GROUP G. COMMERCIAL BUILDINGS OF NON-HAZARDOUS OCCUPANCY.

Sec. 1201. Group G occupancy defined.

Group G occupancies shall be separated into 3 divisions, and include the following:

Division 1. Ice, power, and pumping plants, ice cream plants, cold storage rooms and plants, creameries, breweries, carbarns, and other similar buildings.

Division 2. Factories and workshops using incombustible and non-explosive materials.

Division 3. Buildings for the storage or sale of incombustible and non-explosive materials.

Sec. 1202. Separation of occupancies.

1. Group G 1 occupancy shall be separated from other occupancies in the same building by walls having a fire resistance of at least 3 hours and by floors having a fire resistance of at least 2½ hours. The aggregate openings in such walls shall conform to the provisions of Section 505, 2.

2. Groups G 2 and G 3 occupancies shall be separated from other occupancies in the same building by walls and ceilings having a fire resistance of at least one hour. The aggregate openings, in such walls, on any one floor shall not exceed 240 sq. ft. and every such opening shall be protected by Class C self-closing fire doors.

Sec. 1203. Type of construction, area, height.

All buildings or parts thereof in Group G occupancy shall comply with the following table with regard to type of construction, floor area, and height.

TABLE 1203

Type of Const.	Height in feet	Maximum floor area of building or between fire walls		
		No. of streets on which building fronts		
		1	2	3 or more
1	not hereby limited*	Not hereby limited		
2	75	18,000	20,000	25,000
3	65	10,000	12,000	14,000
4	55	7,000	8,000	10,000
5	35	5,000	6,500	3,000
6	20 1 story	4,000	5,000	6,000

*See Zoning Ordinance.

Note 1: Buildings of Group G 3 occupancy used for storage only, may be of type 5 construction if they are one story in height and do not exceed in area, 6,000 sq. ft. fronting on one street, 7,000 sq. ft. fronting on two streets, and 8,000 sq. ft. fronting on three or more streets.

Note 2: The entire ceiling of basement or cellar, in buildings of Group G occupancy shall be at least one hour fire-resistive construction.

Sec. 1204. Exterior walls.

1. Exterior walls or parts of walls, except where fronting on a street, which are less than ten feet from a property line, shall be of at least two-hour fire-resistive construction and all openings therein shall be protected by Class B fire doors or fire windows.

2. Every portion of an exterior wall which faces, at a distance of less than twenty feet, the further side of a street, or a combustible wall or roof, or an unprotected opening in a wall or roof of another building on the same lot, shall be of at least two-hour fire-resistive construction, and all openings in such portions shall be protected by Class B fire doors or fire windows.

3. In buildings of Type 5 construction exterior walls of unprotected metal may be considered to meet the requirements of this Section for two-hour walls.

Sec. 1205. Enclosure of vertical openings.

The enclosure of vertical openings for buildings of Group G occupancy shall conform with the provisions of Part XXX.

Sec. 1206. Fire extinguishing apparatus.

1. In buildings more than two stories high either portable fire-extinguishers not less than one for every thirty-five hundred square feet of floor area and at least one in each story and basement, or first aid standpipes shall be provided.

2. Fire department standpipes and first aid standpipes shall be provided in buildings more than seventy feet high.

Sec. 1207. Light and ventilation.

Rooms used by human beings shall be provided with light and ventilation by means of windows or skylights with an area at least one eighth of the floor area or shall be provided with artificial light and a mechanically operated ventilating system which shall meet with the approval of the Superintendent.

Sec. 1208. Sanitation.

Refer to Section 4511.

PART XIII.

Requirements Based on Occupancy.

§ 1301. Group H occupancy defined.
§ 1302. Separation of occupancies.
§ 1303. Type of construction, area, height.
§ 1304. Exterior walls.
§ 1305. Exits and enclosures.
§ 1306. Basement and cellar.
§ 1307. Sanitation in multi-family dwellings.
§ 1308. Light and ventilation.
§ 1309. Basement partitions.
§ 1310. Apartments in basements.
§ 1311. Lighting in public halls and stairs.
§ 1312. Fire extinguishing apparatus.
§ 1313. Minimum room size, height and accessibility.

GROUP H. DWELLINGS, LARGE.

Sec. 1301. Group H occupancy defined.

Group H occupancies shall be separated into 2 divisions and include the following:

Division H 1. Hotels, apartment hotels, dormitories, lodging houses, convents, monasteries, and club houses, with 8 or more rooms above the second story.

Division H 2. Apartment houses accommodating more than two families.

Sec. 1302. Separation of occupancies.

1. Group H occupancy shall be separated from other occupancies in the same building by floors and walls having a fire resistance required of the adjoining occupancies, as specified in Parts VI to XV inclusive.

2. Openings in fire separations between adjacent occupancies shall not be allowed in buildings of Group H occupancy. Openings in fire walls within buildings of Group H occupancy shall conform to the provisions of Section 505, 2.

3. Garages of 4 or more car capacity shall be considered as a public garage and as such shall conform with the requirements of Group E 1 occupancy. When the garage is located in the base-

ment or other parts of the building of Group H occupancy, that portion so used shall be separated from the remainder of the building by walls of 4 hour fire-resistive construction and a ceiling or floor of 2½ hour fire-resistive construction. Openings will not be permitted in the ceilings or interior enclosing walls of the garage space. All construction within the garage space shall be of type 1 construction. All openings in the exterior walls shall be protected with Class B fire doors and fire windows. Means for proper ventilation of the garage shall be provided as required by the Superintendent. See Part V for general provisions.

Sec. 1303. Type of construction, area, height.

All buildings or parts thereof in Group H occupancy shall comply with the following table, with regard to type of construction, floor area, and height.

TABLE 1303

Type of Const.	Max. height	No. of stories	Maximum floor area of building or between fire walls
1	not hereby limited*		No limit
2	75	6	18,000
3	55	5	8,000
4	55	4	6,000
5	35	2	6,000
6	40	3	5,000
		Alternate for H 2 occupancy	
4	65	6	3,000 see note 2

*See Zoning Ordinance.

NOTE 1: *Basement Ceilings.* The entire ceiling of basement or cellar in buildings of Group H occupancy shall be at least of 1 hour fire-resistive construction.

NOTE 2: *First Floor and Ceilings of Alternate H 2 Occupancy.* The entire first floor in buildings of the alternate H 2 occupancy shall be of 2½ hours fire-resistive construction. Also, all of the ceilings for the remainder of the building shall be of 1 hour fire-resistive construction.

NOTE 3: *Separation between Apartments.* Partitions forming separations between apartments in buildings of Group H occupancy shall be of at least 1 hour fire-resistive construction.

NOTE 4: *Buildings of Type 6 Construction.* Buildings of type 6 construction for H 2 occupancy shall not exceed 4 apartments nor more than 2 apartments above the first floor. Partitions forming separations between apartments, also around all enclosed stairs, shall be of 1 hour fire-resistive construction.

NOTE 5: *Ceilings for Buildings of Type 3 and 4 Construction.* All of the ceilings in buildings of Group H occupancy of type 3 and 4 construction shall be of 1 hour fire-resistive construction.

Sec. 1304. Exterior walls.

1. Exterior walls or parts of walls, except where fronting on a street which are less than 10′-0″ from a property line, shall be of 4 hour fire-resistive construction and all openings in such walls which are less than 7′-6″ from a property line shall be protected by Class B fire doors or fire windows.

2. Every portion of an exterior wall which faces at a distance of less than 15′-0″, the further side of a street, or a combustible wall or roof of another building, shall be of 4 hour fire-resistive construction, and all openings in such portions shall be protected by Class B fire doors or fire windows.

Sec. 1305. Exits and enclosures.

a. Stairs. 1. In all multi-family dwellings a main stairway, accessible from each apartment, shall extend from the entrance floor to the top floor. The stairs and landings shall be at least 3 feet 4 inches wide between faces of walls, or three feet between face of wall and face of balustrades, or between faces of two balustrades, and no winders shall be allowed. In multi-family dwellings exceeding two stories in height such stairway shall be constructed as specified in Section 3309 and surrounded by the respective types of enclosure specified in Section 3002. Such stairway shall not extend below the entrance floor. In multi-family dwellings exceeding three stories in height the entrance floor of such stairway shall either be of type one construction or, if the floor is of combustible construction, the enclosure walls shall be continued to the basement or cellar floor without openings below the entrance floor.

2. In addition to the main stairway specified above there shall be a second way of egress from each apartment in multi-family dwellings without passing through the first way. In multi-family dwellings of type 1 construction, such second way of egress may be accessible directly from each apartment or may be accessible through

a public corridor. If egress is through a public corridor, the number, arrangement and exits of the stairways shall be satisfactory to the Superintendent. Such second way of egress may be any of the following the owner may elect.

3. In multi-family dwellings not exceeding three stories in height such additional way of egress may be an outside open stairway of wood with wooden balconies or porches, or an interior stairway which, if it extends to the basement or cellar shall be surrounded in the basement by an enclosure of wooden studs covered on the side toward the basement or cellar with 1 hour fire-resistive construction, except as modified in Section 1303, note 4. Any doorway from basement or cellar into such stairway shall be fitted with an approved self-closing Class B fire door. Such interior stairway shall have stairs and landings at least three feet wide between faces of walls or two feet eight inches between face of walls and face of balustrade or between faces of two balustrades, and winders will not be permitted.

4. In multi-family dwellings exceeding three stories in height such second way of egress may be any of the following the owner may elect.

(a) An interior stairway surrounded by the respective types of enclosure specified in Section 3002 and constructed as specified in Section 3309.

(b) Exterior metal or reinforced concrete fire escape, approved as to construction and access.

(c) A horizontal exit as specified in Section 3310.

5. For multi-family dwellings three stories high and with a flat roof, one stairway shall be extended to the roof by stairs or stationary ladder to a scuttle not less than two feet by three feet. For dwellings four stories or more high and with a flat roof, one stairway shall be extended to the roof by stairs through a bulkhead with door not less than 6 feet 8 inches high. No lock shall be placed on any bulkhead door or scuttle, but they may be fastened on the inside by movable bolts or hooks, see Section 3203, b, for construction of bulkhead.

6. Portions of multi-family dwellings separated by fire or party walls may have a common entrance and stairway: Provided, that such stairway and entrance hall are surrounded by the respective types of enclosure specified in Section 3002 and constructed as specified in Section 3309.

b. Entrance Halls. Entrance halls in multi-family dwellings shall be at least 3 ft. 6 in. wide in the clear, and shall be constructed and enclosed like the corresponding stairway.

c. Public Corridors. Public corridors in multi-family dwellings shall be surrounded by enclosures like those specified for stairways in Section 3002, and all doors from public corridors to apartments shall be approved self-closing Class B fire doors, and all windows from public corridors shall be Class B fixed fire windows. The floors in all public corridors in buildings of Group H occupancy of type 3 and type 4 construction shall be at least of 1½ hours fire-resistive construction.

d. Entrance to Basement. In every multi-family dwelling there shall be an entrance to the cellar or other lowest story from the outside.

e. Exists from Buildings of Group H 1 Occupancy. Exits from buildings of Group H 1 occupancy shall conform to the provisions of the Massachusetts Department of Public Safety.

Sec. 1306. Basement and cellar.

Every multi-family building shall have a basement, cellar, or excavated space under the entire entrance floor at least 3 ft. in depth, or shall be elevated above the ground so that there will be a clear space of at least 24 in. between the top of the ground and the bottom of the entrance floor so as to ensure ventilation and protection from dampness. Such space shall in all cases be enclosed, but provided with ample ventilation and properly drained. When necessary to make basement or cellar floors dry, waterproofing shall run through the walls and up the same as high as the ground level and shall be continued throughout the floor, and the said cellar or lowest floor shall be properly constructed so as to prevent dampness or water from entering. All cellars and basements in dwellings shall be properly lighted and ventilated.

Sec. 1307. Sanitation in multi-family dwellings.

a. Sewer Connection. No multi-family dwelling shall be built on any street unless there is a public sewer in such street or a private sewer connecting directly with a public sewer.

b. Prohibitions. 1. No water-closet fixtures shall be enclosed with woodwork.

2. No garbage chute, except an approved incinerator installation, shall be erected in any dwelling.

c. Required Toilet Facilities. 1. Within every apartment there shall be a water-closet in a toilet room or bathroom; such room shall be not less than 3 ft. wide, and shall be enclosed by partitions which shall extend from the floor to the ceiling. In multi-family dwellings such partitions shall not be of finished wood or other absorbent material and no wooden sheathing or wainscoting shall be permitted and the floor shall be made water-proof, and such waterproofing shall extend at least 2 in. above the floor.

2. Nothing in this section shall be construed so as to prohibit in any dwelling a general toilet room containing several water-closet compartments separated from each other by dwarf partitions; provided such toilet room is adequately lighted and ventilated to the satisfaction of the Superintendent, and that such water-closets are supplementary to the water-closet accommodation required by other provisions of this Section. In multi-family dwellings every water-closet compartment shall be provided with proper means of lighting at night. No drip trays shall be permitted in any water-closet. No water-closet shall be placed out of doors. No water closet shall be placed in the cellar of any multi-family dwelling unless such closet is adequately ventilated by a window to the outer air, or by mechanical means.

3. In every apartment there shall be a proper sink or wash bowl with running water, exclusive of any sink in the cellar.

Sec. 1308. Light and ventilation.

a. General. Light and ventilation for Buildings of Group H 1 occupancy shall conform to the regulations of the Massachusetts Department of Public Safety. Light and ventilation for Group H 2 occupancies shall be in accordance with this section.

b. Rooms. 1. The area of a window shall be the clear opening. Every window herein required shall be arranged so that approximately half its area may be opened at one time.

2. Every room, kitchenette, and alcove, except bathrooms and water-closet compartments, shall have a window or windows of a total clear area of not less than 1/8 of the area of the room, so located as to light the room properly, opening upon a street, yard, or court located upon the same lot and of the dimensions specified in Part XXIX: provided, however, that this requirement shall not apply to rooms used for art galleries, swimming pools, gymnasiums, squash courts, or for similar purposes, nor to public rooms in multi-family dwellings, which have approved artificial ventilation.

c. Bathroom. Every water-closet compartment and bathroom shall have at least one window opening directly upon the street, or upon a yard, court or offset to court, and of the dimensions specified in this section. No such window shall be less in size than three square feet and the aggregate area of windows for each water-closet compartment shall not be less than six square feet. A ventilating skylight not less in size than three square feet, open to the sky, may be used in lieu of windows required by this Section. In lieu of the above, water-closet compartments and bathrooms in dwellings and multi-family dwellings, may be equipped with an adequate system of mechanical ventilation giving a complete change of air every 5 minutes while room is being used. Complete specifications and detailed plans of such ventilating systems shall be approved by the Superintendent prior to installation. Upon complaint to the Superintendent of a violation of this Section, the Superintendent shall cause the matter to be investigated and upon proof of such violation the owner of the building shall be liable to a penalty of twenty dollars for each and every day on which such a violation occurs or continues.

d. Public Corridor. 1. Every public corridor extending more than 20 feet from a stair hall shall have at least one window of not less than 12 sq. ft. area opening upon a street, a public alley or open passage-way not less than 10 ft. wide, a yard, a court, an offset of a court, or a vent shaft, all of the dimensions required in Part XXIX or, in lieu of such window, every door opening into such corridor shall have wire glass panel or transom of not less than 320 sq. in. area.

2. Sashes glazed with wire glass may be required by the Superintendent if, in his opinion, they are needed for the adequate lighting of any public corridor.

e. Stair and Entrance Hall. 1. Every public stair hall shall have at least one window on each floor of not less than 12 sq. ft. area opening upon a street, a public alley, or open passageway not less than 10 ft. wide, a court, an offset of a court, or a vent shaft, all of the dimensions required in Part 29: provided, however, that two stairways serving the same apartment shall not open into the same vent shaft and, provided, further, that no such windows shall be required when there shall be, within the space enclosed by the stairway and its landings, from the second story upward, an open area for light and ventilation whose least dimension shall be 3 ft. for a 3 story building and 1 ft. additional for each additional story, and with a skylight directly over the well with an area equal to the area of the well, but not less than 20 sq. ft. in any case. Such skylight shall have either ridge ventilators with a minimum opening of 40 sq. in. or shall have louvres giving a clear area of 40 sq. in.

2. Glazing at the entrance of at least 5 sq. ft. shall be considered adequate for the lighting of the entrance hall between the entrance and the stairs.

Sec. 1309. Basement partitions.

In all buildings of Group H occupancy, hereafter erected, partitions in basements or cellars, including coal-bin partitions shall be of brick or other incombustible materials, except for basement apartments in which the partitions are plastered on both sides. When built to form storage compartments for the use of tenants, they shall be built of metal or wood posts, and the spaces between filled with substantial galvanized wire netting. Doors into such compartments shall be constructed in a similar manner.

Sec. 1310. Apartments in basements.

1. Finished apartments in basements of buildings of Group H occupancy shall be permitted for a janitor or maid but in no case shall there be more than two apartments per building. If more than two apartments are provided, the basement shall be considered the first story.

2. If the walls or floors of a sleeping room or living room are in contact with the ground, the portions thereof in such contact shall be waterproofed or damp-proofed in an approved manner, and the interior finish of such portions of the walls of such rooms shall be furred with impervious material. Not more than 30 per cent of the area of the walls enclosing such a room shall be in contact with the ground.

Sec. 1311. Lighting in public halls and stairs.

Artificial lighting in public halls and stairs shall be provided as described in Section 3308.

Sec. 1312. Fire extinguishing apparatus.

Fire extinguishing apparatus in buildings of Group H occupancy shall be provided in accordance with the regulations of the Massachusetts Department of Public Safety.

Sec. 1313. Minimum room size, height and accessibility.

1. In multi-family dwellings there shall be in each apartment one room of not less than 150 sq. ft. area, and not more than one room, besides kitchenettes and bathrooms, of less than 63 sq. ft. area.

2. No room, except kitchenettes, bathrooms, and water-closet compartments, shall be less than 7 ft. wide, nor shall its length be more than twice its width, the width being the dimension measured along a window wall. No room in a multi-family dwelling shall be less than 8 ft. high from finish floor to ceiling.

3. There shall be access to every living room and bedroom and to at least one water-closet compartment without passing through a bedroom, bathroom, or water-closet compartment.

PART XIV.

Requirements Based on Occupancy.

§ 1401. Group I occupancy defined.
§ 1402. Separation of occupancies.
§ 1403. Type of construction, area, height.
§ 1404. Exterior walls.
§ 1405. Exits.
§ 1406. Basement and cellar.
§ 1407. Sanitation.
§ 1408. Light and ventilation.
§ 1409. Existing dwellings.
§ 1410. Artificial lighting of public halls and stairs.

GROUP I. DWELLINGS, SMALL.

Sec. 1401. Group I occupancy defined.

Group I occupancy shall be separated into 2 divisions and include the following:

Division I-1. Single family dwellings; two family dwellings, one family above the other; semi-detached dwellings; and group dwellings.

Division I-2. Dormitories, lodging houses, clubs, convents, and monasteries with less than 8 rooms above the second story.

Sec. 1402. Separation of occupancies.

1. Buildings of Group I-1 occupancy shall be independent of any other occupancy, except that a private garage, not exceeding 1,000

sq. ft. of floor area, for 3 pleasure cars or less, may be attached to buildings of Group I-1 occupancy provided the walls and ceilings are of 1 hour fire-resistive construction. The provisions of Section 1504 shall also apply.

2. Buildings of Group I-2 occupancy shall be separated from other occupancies in the same building by floors and walls having a fire resistance required of the adjoining occupancies as specified in Parts 6 to 15 inclusive.

3. Openings in fire walls and fire separations between adjacent occupancies shall not exceed 24 sq. ft. and such openings shall be protected by self-closing Class C fire doors.

Sec. 1403. Type of construction, area, height.

TABLE 1403 A

GROUP I-1 OCCUPANCY

Type of Const.	Max. height	Max. no. of stories	Maximum floor area of building or between fire walls
1			No limit
2			8,000
3	35	2½	7,000
4	*		6,000
6			5,000

*See Zoning Ordinance.

TABLE 1403 B

GROUP I-2 OCCUPANCY

Type of Const.	Max. height	Max. no. of stories	Maximum floor area of building or between fire walls
1			No limit
2	40	3	12,000
3	*		8,000
4			6,000
6	35	2½	5,000

*See Zoning Regulations.

NOTE 1: Partitions forming separations between adjoining apartments shall be of not less than one hour fire resistive construction.

NOTE 2: The basement or cellar ceiling in buildings of Group I-2 occupancy shall be at least of 1 hour fire-resistive construction. The basement or cellar ceiling in buildings of Group I-1 occupancy need not be protected except directly over the boiler, where there shall be 1 hour fire-resistive construction for an area two feet around the outside of the boiler.

Sec. 1404. Exterior walls.

Exterior walls or parts of walls in buildings of Group I occupancy shall not be less than 7′-6″ from a property line or as permitted by the zoning ordinance.

Sec. 1405. Exits.

a. Buildings of I-1 occupancy. 1. Each apartment shall be provided with at least two exits located as far apart as possible. In two family dwellings, one family above the other, one of the required exits shall be enclosed with walls of 1 hour fire-resistive construction.

b. Buildings of I-2 occupancy. Exits in buildings of Group I-2 occupancy shall conform to the provisions of Part XXXIII.

Sec. 1406. Basement and cellar.

The basement and cellar in buildings of Group I occupancy shall conform to the provisions of Section 1306.

Sec. 1407. Sanitation.

Sanitation facilities in buildings of Group I occupancy shall conform to the provisions of Section 1307, c 1, c 2, c 3.

Sec. 1408. Light and ventilation.

Light and ventilation in buildings of Group I-2 occupancy shall conform to the provisions of Section 1308, b 1, b 2; 1308, c; 1308, d; 1308, e 1, and e 2.

Sec. 1409. Existing dwellings.

Dwellings existing prior to the passage of this Code shall conform to the provisions of Part XLIII and pertinent provisions of Part II.

Sec. 1410. Artificial lighting of public halls and stairs.

The artificial lighting of public halls and stairs in buildings of Group I-2 occupancy shall conform to the provisions of Section 3308.

PART XV.

Requirements Based on Occupancy.

§ 1501. Group J occupancy defined.
§ 1502. Permits.
§ 1503. Separation of occupancies.
§ 1504. Garages for three cars or less.
§ 1505. Grandstands.
§ 1506. Greenhouses.
§ 1507. Tents.
§ 1508. Temporary buildings.
§ 1509. Amusement devices.
§ 1510. Radio towers.
§ 1511. Open shelters.

GROUP J MISCELLANEOUS STRUCTURES.

Sec. 1501. Group J occupancy defined.

Group J occupancy shall be separated into two divisions and include the following:

Division J-1. Garages for 3 cars or less.

Division J-2. Grandstands, greenhouses, radio towers, open shelters, tents and other miscellaneous structures.

Sec. 1502. Permits.

Prior to the erection of any building or structure under Group J occupancy the owner or owners shall obtain a building permit in accordance with Section 207.

Sec. 1503. Separation of occupancies.

1. A private garage not exceeding 1,000 sq. ft. in area, for the storage of three cars or less shall be separated from other occupancies in the same building by walls and ceiling having a fire-resistive construction of at least 1 hour. Openings in such fire separation shall not exceed 24 sq. ft. in area and such openings shall be protected by Class C self-closing fire doors or fixed Class B fire windows.

2. A public garage not exceeding 1,000 sq. ft. in area, for 3 cars or less shall be separated from other occupancies in the same building by walls having a fire-resistive construction of at least 2 hours and ceiling of 1 hour. Openings in such fire separation shall not exceed

24 sq. ft. in area and shall be protected by Class B self-closing fire doors or fixed Class B fire windows.

3. Greenhouses and other miscellaneous structures shall be separated from other occupancies in a manner that will meet with the approval of the Superintendent.

Sec. 1504. Garages for three cars or less.

Exterior walls or parts of walls for buildings of Group J-1 occupancy, except where fronting on a street, which are less than 5 ft. but not less than 2 ft. from a property line, or less than 10 ft. from a combustible building, except attached private garages, shall be of not less than 2 hour fire-resistive construction and all openings therein shall be protected by Class B fire doors or fire windows. Such walls that are less than 2 ft. from a property line or 10 ft. from a combustible building shall be at least 3 hour fire-resistive construction and all openings therein shall be protected by self-closing Class B fire doors, or fixed Class B fire windows.

Sec. 1505. Grandstands.

a. Approval by Abutters. Every person, firm or corporation desiring a permit for the construction of a permanent grandstand, shall first obtain the consent in writing of all the abutters of the lot on which it is proposed to erect such grandstand, also, it will be necessary to obtain the written consent of 75 per cent of all the owners of the lots within a radius of 200 ft. from the center of the lot on which it is proposed to erect such grandstand. If more than one-third of a lot area lies within the 200 ft. radius, the owner of such lot shall be considered as within the 200 ft. radius. If the above requirements are complied with and the proposed structure meets with the requirements of this Code, a permit shall be granted, provided that the requirements of this Section shall not apply to any temporary structure.

b. Permanent Grandstands. 1. Permanent grandstands of wood construction, either with or without canopy, may be erected when not nearer than 10 ft. from adjoining property lines, or 20 ft. to any frame buildings. The highest level of seats shall not exceed 10 ft., nor shall the total horizontal area exceed 5,000 sq. ft.

2. Grandstands of metal, concrete or masonry construction shall not be limited as to height, area or location with regard adjoining property lines or other buildings.

3. The width, location and number of aisles, stairs and seats shall meet with the approval of the Superintendent.

4. No space under any grandstand shall be used for any purpose unless the part so used is of type 1 construction.

c. Temporary Grandstands. Temporary grandstands may be erected for a limited time. Their construction shall be approved by the Superintendent and the permit for their construction shall state the length of time of use and the further length of time for removal.

Sec. 1506. Greenhouses.

Greenhouses or hot houses built of Type 6 construction shall not exceed 600 sq. ft. in floor area nor 15 ft. to the highest point. Such buildings must be at least 3 ft. from the lot line and 10 ft. from a combustible building. If of steel skeleton construction, they may be built up to 2,000 sq. ft. in floor area, and at least 3 ft. from the lot line and 10 ft. from a combustible building. Greenhouses exceeding 2,000 sq. ft. in floor area shall be separated by masonry walls of at least 3 hour fire-resistive construction for every 2,000 sq. ft. or fraction thereof. Openings in fire walls shall not exceed 100 sq. ft. and such openings shall be protected with Class B self-closing fire doors or fixed Class B fire windows. Greenhouses of 200 sq. ft. or less may be attached to dwellings.

Sec. 1507. Tents.

1. Permits may be issued for the erection of tents for a period not to exceed 30 days for the use of religious purposes, entertainment, bazaars and similar use. They shall not be erected nearer than 20 ft. from the adjoining property line or other building. They shall be constructed and erected to resist a wind pressure of 10 pounds per sq. ft. When used for an assembly of people, it shall be necessary to obtain a certificate of egress from the Massachusetts Department of Public Safety before the issuance of a permit by the Superintendent. Approved means for extinguishing fires shall be kept on the premises ready for use, as directed.

2. Tents not exceeding 120 sq. ft. in area when erected in the rear of dwellings shall be exempt from the requirements of this Section.

Sec. 1508. Temporary buildings.

a. General. 1. All temporary buildings or structures such as construction offices, real estate offices, sidewalk coverings, scaffolds, barricades, and other similar buildings, shall be approved by the Superintendent, as to construction and location.

2. Any temporary structure or building extending in or over public ways shall require the approval of the Street Department prior to the issuance of a permit by the Superintendent.

b. Restrictions. The distance from lot line, not fronting a street, shall be a minimum of 3′-0″, and 10′-0″ from any other building on the same lot.

Sec. 1509. Amusement devices.

Amusement devices such as roller coaster, scenic railway, elevated automobile coaster, or other riding, sliding or rolling devices shall be under the jurisdiction of the Board of License Commissioners of the City of Cambridge.

Sec. 1510. Radio towers.

1. All radio towers shall be of metal construction and shall be securely braced and of sufficient strength to resist the following loads: 30 pounds of wind pressure on the area of any solid tower or on twice the net area of one side of the tower if of latticed construction, plus the actual stresses from antenna due to dead load plus maximum wind load with tower and antenna covered with ice. For broadcasting stations these loads shall be not less than a vertical ice load of 2,500 pounds, a horizontal antenna pull of 2,000 pounds and a transverse antenna pull of 400 pounds, all loads acting simultaneously.

2. All towers shall be built entirely of structural elements not less than 3/16 inch thick, all heavily galvanized. When erected on the ground all such towers shall have adequate foundations. When erected on buildings the frame or walls of buildings shall be of adequate strength to support safely all loads and the weight of any portion of the structures required to resist uplift shall be at least twice the maximum calculated uplift.

3. All towers shall be provided with step bolts on one leg of tower or a ladder on one face.

4. Guy wires to such towers shall not cross or encroach upon any public street or alley, nor cross over any electric power wire, nor cross any privately owned property without the consent of the owner. All such towers shall be securely grounded with a metal conductor, as required under Part XLI of this Code.

Sec. 1511. Open shelters.

Open shelter sheds of wood or of metal construction not less than No. 24 gauge nor exceeding 15 feet in height, 300 sq. ft. in floor area, may be erected, if at least 5 feet from adjoining property lines and 10 feet from any other building or open shelter shed on the same property except that such sheds may abut against unpierced masonry walls of buildings on the same property.

PART XVI.

Classification by Type of Construction.

§ 1601. Classification.
§ 1602. Separation of occupancies.
§ 1603. Buildings not covered under section 1601.
§ 1604. Minimum requirements.
§ 1605. Fire-resistive protection.
§ 1606. Greater restrictions.
§ 1607. General requirements for all types of construction.

GENERAL PROVISIONS.

Sec. 1601. Classification.

For the purpose of this Code all buildings shall be classified according to varying degrees of resistance to fire, to the character of materials used and their methods of construction. The types will include the following:

Type 1. Fireproof Construction.
Type 2. Semi-fireproof Construction.
Type 3. Heavy Timber and Masonry Construction.
Type 4. Light Wood and Masonry Construction.
Type 5. Unprotected Metal Construction.
Type 6. Wood Frame Construction.

Sec. 1602. Separation of occupancies.

When two or more groups of occupancy occur in the same building and are separated as provided in Sections "Separation of Occupancies" in Parts VI to XV inclusive, each portion shall be classified as of the type of construction to which it conforms. If, however, there is no separation between such occupancies, the entire building shall be subject to the classification of the most fire-resistive type.

Sec. 1603. Buildings not covered under section 1601.

Any proposed or existing building which cannot readily be classified as types 1 to 6 inclusive shall for the purpose of this Code, be assigned by the Superintendent, to the fire-resistive type to which it most nearly conforms.

Sec. 1604. Minimum requirements.

The requirements herein described are the minimum requirements for the various types of construction. A building may be classed as a specific type of construction only when all of the requirements for that type are complied with.

Sec. 1605. Fire-resistive protection.

The fire-resistive protection for the various types of construction shall conform to the requirements of table 1605 and as established in Part XXXVII.

Sec. 1606. Greater restrictions.

Table 1605 and the provisions of Parts XVI to XXII inclusive are to be considered the minimum. Other restrictive provisions given under occupancy classifications, Parts V to XV inclusive shall also be complied with.

Reference Notes:

(1) Fireproofing may be omitted from lintels spanning 8′ or less.

(2) Non-bearing permanent partitions within the floor area of a building occupied by one tenant may be one hour fire-resistive construction. Temporary dividing partitions in stores or offices occupied by the same tenant may be of metal or wood panels.

Sec. 1607. General requirements for all types of construction.

a. *Roof Structures.* Roof structures shall conform to the provisions of Part XXXII.

b. *Stair Construction.* Stair construction shall conform to the provisions of Part XXXIII.

c. *Parapet Walls.* Parapet walls shall be constructed as specified in Section 2433.

d. *Roof Covering.* Roof covering shall conform to the provisions of Section 3705.

TABLE 1605

MINIMUM FIRE-RESISTIVE REQUIREMENTS

(See Part 37 for fire-resistive standards)

	DESCRIPTION	Type 1 Fireproof	Type 2 Semi-fire proof	Type 3 Heavy tim. & masonry	Type 4 Light wood & masonry	Type 5 Unpro. Metal	Type 6 Wood Frame
Walls and Partitions	Party walls	4 hrs.	4 hrs.	4 hrs.	4 hrs.	4 hrs.	4 hrs.
	Exterior bearing walls	4 hrs.	3 hrs.	3 hrs.	3 hrs.	Incombus.	No require.
	Exterior non-bearing walls	2½ hrs.	2 hrs.	2 hrs.	2 hrs.	Incombus.	No require.
	Penthouse encl. walls (not directly above fire separation and/or exterior walls)	....	....	See Section 3203b	....	....	....
	Courts	....	....	See Part 2906	....	....	....
	Bearing partition	3 hrs.	3 hrs.	2½ hrs.	No require.	Incombus.	No require.
	Non-bearing partition	2 hrs. (2)	1 hr. (2)	1 hr. (2)	No require.	Incombus.	No require.
Cols.	Supporting masonry walls (1)	4 hrs.	3 hrs.	3 hrs.	2 hrs.	2 hrs.	1 hr.
	Supporting roofs only	2 hrs.	1 hr.	8″ x 8″ tim. or 1-hr.	No require.	Incombus.	No require.
	Other columns	4 hrs.	2 hrs.	8″ x 8″ tim. or 1-hr.	No require.	Incombus.	No require.
Trusses	Supporting masonry walls	4 hrs.	3 hrs.	3 hrs.	2 hrs.	2 hrs.	1 hr.
	Supporting floors	4 hrs.	3 hrs.	6″ x 6″ tim. or 1-hr.	No require.	Incombus.	No require.
	Supporting roofs only	2½ hrs.	1 hr.	4″ x 4″ tim. or 1-hr.	No require.	Incombus.	No require.
	Supporting roofs only and more than 25′ above floor	1 hr.	4″ x 4″ tim. or incom.	4″ x 4″ tim. or incom.	No require.	Incombus.	No require.
Girders	Supporting masonry walls	4 hrs.	3 hrs.	3 hrs.	2 hrs.	2 hrs.	1 hr.
	Supporting floors	4 hrs.	2 hrs.	10″ x 10″ tim. or 1-hr.	No require.	Incombus.	No require.
	Supporting roofs only	2½ hrs.	1 hr.	8″ x 10″ tim. or 1-hr.	No require.	Incombus.	No require.
	Supporting roofs only and more than 25′ above floor	1 hr.	Incombus.	8″ x 10″ tim. or 1-hr.	No require.	Incombus.	No require.
Beams	Supporting masonry walls (1)	4 hrs.	3 hrs.	3 hrs.	2 hrs.	2 hrs.	1 hr.
	Supporting floors	2½ hrs.	1½ hrs.	6″ x 10″ tim. or 1-hr.	No require.	Incombus.	No require.
	Supporting roofs only	2½ hrs.	1 hr.	6″ x 10″ tim. or 1-hr.	No require.	Incombus.	No require.
	Supporting roofs only and more than 25′ above floor	1 hr.	Incombus.	6″ x 10″ tim. or 1-hr.	No require.	Incombus.	No require.
	Floor panels—Joists, slabs	2½ hrs.	1½ hrs.	3″ sheathing	No require.	Incombus.	No require.
	Roof panels—Rafters, slabs	2½ hrs.	Incombus.	2″ sheathing	No require.	Incombus.	No require.
	Panels more than 25′ above floor	Incombus.	Incombus. or 2″ sheathing	Incombus. or 2″ sheathing	No require.	Incombus.	No require.
	Roof covering	....	....	See Section 3705	....	....	....
	Height of buildings			See Parts 5 through 15 inclusive and zoning ordinance			

PART XVII.

Type 1 Construction.

§ 1701. Type 1 defined.
§ 1702. Projections from buildings.
§ 1703. Unprotected steel and wood.

(FIREPROOF CONSTRUCTION).

Sec. 1701. Type 1 defined.

Buildings of type 1 construction shall have exterior walls, fire walls and party walls of brick, stone, concrete or other equally substantial and fire-resistive materials; floor and roof construction of metal, reinforced concrete, terra cotta, brick, or other equally fire-resistive materials; all of the above construction as well as the interior partitions shall have a fire-resistance of not less than specified in table 1605 and described in Part XXXVII. See Part XVI for general provisions.

Sec. 1702. Projections from buildings.

1. Porches and exterior balconies shall be constructed of incombustible materials. Structural steel or iron members not part of the main structural frame need not be fireproofed.

2. Loading platforms may be of heavy timber construction. Such wood construction shall not be extended through the exterior wall.

3. Cornices, bays and other projections shall be constructed of incombustible materials. Marquees shall be constructed as required in Section 3611.

Sec. 1703. Unprotected steel and wood.

1. All interior finish may be of wood or other approved material such as finished and rough floors, window and door frames, sashes, doors, chair rails, bases, trims, hand rails for stairs and necessary sleepers or furrings bedded in concrete or mortar. Wooden wainscotting, panelling and other surface covering may be used on walls, partitions, and ceilings when applied direct or to nailing strips and without concealed spaces; provided, that such material used in a room or space exceeding 5000 square feet in area, shall have been treated to render it non-flammable. Exterior doors and windows may generally be of wood except as provided in section "Exterior Wall" of Parts VI to XV inclusive.

2. Show window frames and aprons, show cases and other appurtenances may be of wood or unprotected metal.

PART XVIII.

Type 2 Construction.

§ 1801. Type 2 defined.
§ 1802. Projection from buildings.
§ 1803. Unprotected steel and wood.
§ 1804. Wall assemblies.

(SEMI-FIREPROOF CONSTRUCTION).

Sec. 1801. Type 2 defined.

Buildings of type 2 construction shall have exterior walls, fire walls and party walls of brick, stone, concrete or other equally substantial and fire-resistive materials, floor and roof construction of metal, reinforced concrete, terra cotta, brick, or other equally fire-resistive materials; all of the above construction as well as the interior partitions shall have a fire resistance of not less than specified in table 1605 and described in Part XXXVII. See Part XVI for general provisions.

Sec. 1802. Projection from buildings.

1. Porches and exterior balconies shall be constructed of incombustible materials. Structural steel or iron members not part of the main structural frame need not be fireproofed.

2. Loading platforms may be of heavy timber construction. Such wood construction shall not be extended through the exterior wall.

3. Cornices, bays and other projections shall be constructed of incombustible materials. Marquees shall be constructed as required in Section 3611.

Sec. 1803. Unprotected steel and wood.

1. All interior finish may be of wood or other approved material such as finish and rough floors, window and door frames, sashes, doors, chair rails, bases, trims, hand rails for stairs and necessary sleeper furrings bedded in concrete or mortar. Wooden wainscotting, panelling and other surface covering may be used on walls, partitions and ceilings when applied direct or to nailing strips and without concealed spaces; provided that such material used in a room or space exceeding 5000 sq. ft. in area, shall have been treated to render it non-flammable. Exterior doors and windows may generally be of

wood except as provided in section "Exterior Walls" of Parts VI to XV inclusive.

2. Show window frames and aprons, show cases and other appurtenances may be of wood or unprotected metal.

Sec. 1804. Wall assemblies.

In buildings not over 3 stories in height except as noted herein, exterior walls consisting of assemblies of materials may be used in buildings of type 2 construction when such walls provide at their outer face fire resistance not less than specified in Table 1605. Structural members in such walls shall be incombustible and shall be protected to provide not less than 2 hour fire resistance at the inner face of such walls. Such wall constructions shall not be used in Group E Commercial Buildings of Hazardous Occupancy over 1 story in height, nor in detention buildings of Division 1 of Group D Occupancy. All such proposed construction shall be in accordance with Section 204-h and shall meet with the approval of the Superintendent.

PART XIX.

Type 3 Construction.

§ 1901. Type 3 defined.
§ 1902. Projection from buildings.
§ 1903. Unprotected steel and wood.

(HEAVY TIMBER AND MASONRY CONSTRUCTION).

Sec. 1901. Type 3 defined.

Buildings of type 3 construction shall have exterior walls, party walls and fire walls of brick, stone or reinforced concrete or other equally substantial and fire-resistive materials; the framing shall be of heavy timber without concealed air spaces, or in part of protected steel or reinforced concrete having a fire resistance of at least the rating specified in Table 1605 and defined in Part XXXVII. See Part XVI for general provisions.

Sec. 1902. Projection from buildings.

1. Porches and exterior balconies shall be constructed of incombustible materials. Structural steel or iron members not part of the main structural frame need not be fireproofed.

2. Loading platforms may be of heavy timber construction. Such wood construction shall not be extended through the exterior wall.

3. Cornices, bays and other projections shall be constructed of incombustible materials. Marquees shall be constructed as required in Section 3611.

Sec. 1903. Unprotected steel and wood.

1. All interior finish may be of wood or other approved material such as finish and rough floors, window and door frames, sashes, doors, chair rails, bases, trims, hand rails for stairs and necessary sleepers or furrings bedded in concrete or mortar. Wooden wainscotting, panelling and other surface covering may be used on walls, partitions and ceilings when applied direct or to railing strips and without concealed spaces; provided that such material used in a room or space exceeding 5000 square feet in area, shall have been treated to render it non-flammable. Exterior doors and windows may generally be of wood except as provided in Section "Exterior Walls" of Parts VI to XV inclusive.

2. Show window frames and aprons, show cases and other appurtenances may be of wood or unprotected metal.

PART XX.

Type 4 Construction.

§ 2001. Type 4 defined.
§ 2002. Projections from buildings.
§ 2003. Combustible materials regulated.

(LIGHT WOOD AND MASONRY CONSTRUCTION).

Sec. 2001. Type 4 defined.

Buildings of type 4 construction shall have exterior walls, fire walls and party walls of brick, stone, concrete or other equally substantial and fire-resistive materials; floors, roofs, structural framing and partitions partly or wholly of wood, or unprotected metal, except stairs and vertical enclosures which shall conform with Section 3309 and Part XXX respectively. In other respects, buildings of type 4 construction shall conform with the provisions of Table 1605 and as defined in Part XXXVII. See Part XVI for general provisions.

Sec. 2002. Projections from buildings.

1. Bays, gutters, cornices and porches for buildings of type 4 construction shall be of incombustible construction, for buildings exceeding 2 stories in height. Such projections may be of wood for buildings 2 stories or less in height.

2. Marquees and similar projections shall be constructed as specified in Section 3611.

Sec. 2003. Combustible materials regulated.

1. The entire basement or cellar ceiling in buildings of type 4 construction shall be protected with 1 hour fire-resistive construction as described in Part XXXVII.

2. Fire stopping shall be provided as required under Section 2511.

PART XXI.

Type 5 Construction.

§ 2101. Type 5 defined.
§ 2102. Projections from buildings.
§ 2103. Combustible materials regulated.
§ 2104. Permissible construction.

(UNPROTECTED METAL CONSTRUCTION).

Sec. 2101. Type 5 defined.

Buildings of type 5 construction shall have exterior walls, frames, floors and roofs of metal or other incombustible materials which may be protected against fire. Party walls and fire walls shall be of brick, concrete or other equally fire-resistive construction in accordance with Table 1605 and Part XXXVII. See Part XVI for general provisions.

Sec. 2102. Projections from buildings.

Cornices, and porches or exterior balconies on buildings of type 5 construction shall be of incombustible materials.

Sec. 2103. Combustible materials regulated.

Wood shall not be permitted in buildings of type 5 construction except as permitted for type 1 buildings, see Section 1703.

Sec. 2104. Permissible construction.

Buildings of type 5 construction, other than those provided under Section 1103 will be permitted provided they comply with the requirements of the zoning ordinances and meet with the approval of the Superintendent of Buildings and Board of Appeal.

PART XXII.

Type 6 Construction.

§ 2201. Type 6 defined.
§ 2202. Projections from buildings.
§ 2203. Exterior wall covering.
§ 2204. Fire stopping.

(WOOD CONSTRUCTION).

Sec. 2201. Type 6 defined.

Buildings of type 6 construction may have frames, walls, floors, roofs and partitions of wood construction, and shall in other respects conform with the provisions of Table 1605 and the remainder of this Part. See Part XVI for general provisions.

Sec. 2202. Projections from buildings.

All projections from buildings of type 6 construction may be of combustible materials.

Sec. 2203. Exterior wall covering.

a. Masonry Veneer. Masonry veneer construction as described in Section 2422, b, shall be acceptable for buildings of type 6 construction.

b. Galvanized or Enamel Iron. Galvanized or enamel iron not less than 28 U. S. standard gauge applied on 7/8″ sheathing or other approved material shall be acceptable for buildings of type 6 construction.

c. Stucco. Stucco on galvanized metal lath applied to 7/8″ sheathing or other approved material and applied in accordance with Part 42 shall be acceptable for buildings of type 6 construction.

d. Other Wall Covering. Exterior walls for buildings of type 6 construction, in addition to the above, may be covered with shingles, clapboards, siding or other approved wall covering.

Sec. 2204. Fire stopping.

Fire stopping shall be provided as required under Section 2511.

PART XXIII.

Live and Dead Loads, Weight of Materials.

§ 2301. General.
§ 2302. Notation on plans.
§ 2303. Live loads on floors.
§ 2304. Reduction of live loads.
§ 2305. Loads from partitions.
§ 2306. Roof loads.
§ 2307. Wind loads.
§ 2308. Posting floor loads.
§ 2309. Weight of materials.
§ 2310. Tests on completed work.
§ 2311. Change of occupancy.

Sec. 2301. General.

Every building or structure or part thereof hereafter erected shall be well and substantially constructed in a sound and workmanlike manner and shall be designed to carry at least the actual dead loads and the minimum live loads required in this part without stressing any of the structural elements beyond the allowable stresses prescribed in this code. In addition to vertical loads, all buildings and other structures shall be adequately braced against all lateral or horizontal stresses due to wind pressure, operation of machinery, settlement of foundations and all other ordinary conditions. In designing members to support moving bodies, the weight of such bodies shall be multiplied by an impact factor from 1¼ to 2, the exact factor to be determined by the Superintendent.

Sec. 2302. Notation on plans.

Plans for other than residential buildings, filed with the Superintendent for permits, shall show the live loads per square foot for which the building is designed.

Sec. 2303. Live loads on floors.

a. General. 1. Live loads shall include all loads except dead loads. Every application for a permit shall state the purpose for which the building is to be used and every floor shall be of sufficient strength to bear safely the weight to be imposed thereon in addition to the dead load, but shall safely support a minimum uniformly distributed live load per sq. ft. as specified in the following table:

	Lbs. per sq. ft.
Armories	150
Assembly halls, gymnasiums	100
Fire houses	
Apparatus floors	250
Living portions	40
Garages (private) storage and repair floors	75
Garages (public)	
1st floor (except those limited to passenger vehicles exclusively)	250
1st floor passenger vehicles only	150
Other floors	150
Grandstands	100
Hangars	150
Hotels, lodging houses, boarding houses, dormitories, convents, clubs, hospitals, asylums, detention buildings	
Public portion (including corridors)	100
Residence portion	40
Office buildings	
First and basement floors	100
Above first floor, including corridors	75
Residence buildings (including porches)	40
Schools, colleges	
Assembly halls	100
Classrooms, never to be used as assembly halls and corridors	50
Sidewalks	250
(or 8000 lbs. concentrated, whichever gives the larger moment or shear)	
Stables	
Street floor, feed room	150
All other areas	50
Stairs—Same as heaviest occupancy to which they give access	
Maximum required	100
Churches	
Auditoriums, corridors	75
Other areas	50
Theatres, auditoriums and corridors	75
Stage	100
Fire escapes and balconies	100

	Lbs. per sq. ft.
Stores	
Retail	100
Wholesale	125
Storage	
Light	125
Heavy	250
Manufacture	
Heavy	150
Light	100

Roof loads see Section 2306

2. The Superintendent may require design for heavier loads than the above minimum values if, in his judgment, the use of the building requires it.

3. For buildings or structures not included in the above table, the Superintendent shall establish allowable live loads.

b. Concentrated Loads for Public Garages. Floors in public garages shall, in addition to the requirements above, be designed to safely support a system of concentrated loads as follows. The concentrated loads for floors having more than 8 ft. 6 in. clear head room under beams and girders shall be assumed as 2,500 pounds each, and for other floors 1,500 pounds each; each such load shall be assumed as concentrated on an area of 6 in. by 6 in.; the loads shall be distributed in a rectangular pattern and the distribution shall be such that the lines of centers shall be spaced alternately at 2 feet 4 inches and 4 feet 8 inches in one direction and shall be spaced alternately at 5 feet and 10 feet in the other direction. The arrangement of loads giving the greatest stresses, either in shear or bending, shall be used in designing the elements of the floor, but no element of the floor shall carry a safe load of less than the required uniform live load, except as permitted in Section 2304.

c. Loads for Driveways. Driveways over vaults, tunnels and areas shall be designed to support one or more trucks, depending upon the room available, with the following assumptions: The load on the rear axle shall be assumed to be 24,000 pounds and that on the front axle 12,000 pounds. The wheelbase shall be taken as 13 feet. The arrangement of wheels giving the greatest stress in bending or shear shall be assumed for purposes of design, but in no case shall safe uniform live load be less than 250 pounds per sq. ft.

Sec. 2304. Reduction of live loads.

1. The following reductions in assumed live loads shall be per-

mitted in designing of columns, piers, walls, foundations, trusses and girders.

2. No reduction of the assumed live load shall be allowed in the design of any slab, joist or beam.

3. A reduction of the total live load used in the design of girders based on a definite tributary floor area shall be permitted as noted in the following schedule. This reduction shall not be carried into the columns nor shall such reduction be used in the design of buildings to be used or occupied as warehouses or for storage.

Reduction	Tributary Floor Area in sq. ft.
5%	100
10%	200
15%	300 or more

4. For determining the total live loads carried by columns, walls, piers and foundations the following reductions shall be permitted, the reductions being based on the assumed live loads applied to the entire tributary floor area.

No. of floors	Warehouse and storage bldgs.	Mfg. bldgs. stores and garages	All other bldgs.
Carrying the roof	0	0	0
Carrying 1 floor	0	0	0
Carrying 2 floors	5	10	10
Carrying 3 floors	10	20	20
Carrying 4 floors	15	30	30
Carrying 5 floors	20	30	40
Carrying 6 floors	20	30	45
Carrying 7 floors or more	20	30	50

Sec. 2305. Loads from partitions.

1. In buildings in which permanent partitions occur their weight shall be counted as affecting the design of all supporting structural members, including columns and foundations, as part of the dead load.

2. If a lay-out of partitions is included on the building plans, the weight of the partitions and their locations shall be determined

in accordance therewith, or such lay-out shall be used to determine an equivalent load per square foot of floor to be applied uniformly as a superimposed dead load for purposes of design. But the allowance for partition weight in portions of buildings given to office occupancy, when expressed in pounds per square foot of floor, shall in no case be less than a minimum of two pounds for each foot of clear story height.

3. In estimating loading from actual weight of partitions it may be assumed that the partition occupies a space one foot wide, and a deduction may be made of the live load displaced on this width.

Sec. 2306. Roof loads.

1. Roofs shall be designed to safely support minimum live loads as follows:—

2. Roof with pitch of 4 in. or less per ft. a vertical load of 30 lbs. per horizontal sq. ft. applied either to half or to the whole of the roof.

3. Roofs with pitch of more than 4 in. and not more than 8 in. per ft., a vertical load of 20 lbs. per horizontal sq. ft. and a wind load of 10 lbs. per sq. ft. of surface acting at right angles to one slope, these two loads being assumed to act either together or separately.

4. Roofs with pitch of more than 8 in. and not more than 12 in. per ft., a vertical load of 10 lbs. per horizontal sq. ft. and a wind load of 20 lbs. per sq. ft. of surface acting at right angles to one slope, these two loads being assumed to act either together or separately.

5. Roofs with pitch of more than 12 in. per ft., a vertical load of 10 lbs. per horizontal sq. ft. and a wind load of 30 lbs. per sq. ft. of surface acting at right angles to one slope, these two loads being assumed to act either together or separately.

Sec. 2307. Wind loads.

1. All buildings and structures shall be calculated to resist a pressure per square foot on any vertical surface as follows:

For forty feet in height	Ten Pounds
Portions from forty to eighty feet above ground	Fifteen Pounds
Portions more than eighty feet above ground	Twenty Pounds

2. Except that for tank towers, stacks and other exposed structures on the top of buildings shall be designed to withstand an assumed wind pressure of twenty pounds per square foot of gross ex-

posed projected area. For cylindrical surfaces the area exposed to wind shall be assumed as two-thirds of the projected area.

3. All buildings and structures shall be made capable of resisting horizontal wind pressures on their exposed vertical surfaces, and wind pressures normal to their sloping roofs without exceeding the stresses allowed in this Code.

4. Wind bracing shall be provided for all structures whose height is more than two and one-half times the least width and for one-story shops, auditoriums, drill sheds and structures of similar character.

5. The overturning moment due to wind pressure shall not exceed two-thirds of the moment of stability (as measured by the moment of the dead loads, about the leeward edge of the foundation or critical section at any other level) unless the structure is anchored to resist the excess overturning moment without exceeding the stresses prescribed.

Sec. 2308. Posting floor loads.

1. It shall be the duty of the owner or tenant, leasing for one year or more any warehouse, storage or manufacturing building, or the storage portion of any mercantile building existing at the time this Code is adopted or erected thereafter, to post in conspicuous places throughout such buildings, placards setting forth the safe live loads for which such buildings may be used with the following legend in letters at least 2 inches high: "THE MAXIMUM SAFE LIVE LOAD ON THIS FLOOR IS................POUNDS PER SQUARE FOOT."

2. It shall be unlawful to fail to place such placards, or to place placards showing a higher safe load than that allowed by the Superintendent, or to remove, cover up, alter or deface such placards.

3. It shall be the duty of the Superintendent to check and approve or show cause for disapproving any calculations as to the safe carrying capacity of any floor construction, and in order to so check such calculations, he shall be allowed to examine any plans of such buildings in the possession of the owner or his agent, or may require any portions of the buildings to be uncovered for inspection, including footings, that he deems necessary.

4. It shall be unlawful for any owner, agent or tenant to advertise or represent any building to have a greater safe load upon the floors than that allowed by the Superintendent.

Sec. 2309. Weight of materials.

Dead loads shall consist of the weight of the walls, floors, roofs, and permanent partitions.

The weight of various materials shall be assumed as follows:

	Lbs. per cu. ft.
Ashlar Masonry	
Granite	165
Limestone, marble	160
Sandstone	140
Brick Masonry	
Pressed brick	140
Common brick	120
Paving brick	150
Cast iron	450
Cast stone	144
Concrete Masonry	
Cement, stone, sand (reinforced)	150
Cement, stone, sand (plain)	144
Cement, slag	130
Cement, cinder	100
Earth, dry packed	95
Glass	160
Steel	490
Spruce	30
Hemlock	30
Douglas fir	30
Yellow pine	40
Oak	50
Terra Cotta, architectural, voids unfilled	72
Terra Cotta, architectural, voids filled	120
Gypsum block	48
Hollow Tile, wall bearing	60
Hollow Tile, partition	54
Snow (wet)	50

Sec. 2310. Tests on completed work.

In case there is reason to question the safety of a floor or other structural part of a building or structure in course of construction or before a certificate of occupancy has been issued, the Superintendent may require the owner or builder to make load tests or other suitable tests to determine the acceptability of the construction. Such tests shall be made under the supervision of the Superintendent and shall show that the construction in question will sustain without serious distress a load equal to twice the designed live-load.

Sec. 2311. Change of occupancy.

No change in the occupancy of a building now existing or hereafter erected shall be made unless the floors are adequate for the loads characteristic of the proposed occupancy.

PART XXIV.

Masonry Construction.

§ 2401. Masonry materials.
§ 2402. Fire protection.
§ 2403. Brick.
§ 2404. Stone.
§ 2405. Cast stone.
§ 2406. Concrete block.
§ 2407. Structural clay tile.
§ 2408. Gypsum tile, mortar.
§ 2409. Plain concrete.
§ 2410. Plain gypsum concrete.
§ 2411. Mortars.
§ 2412. Safe loads for masonry.
§ 2413. Thickness of masonry walls.
§ 2414. Workmanship and weather.
§ 2415. Piers.
§ 2416. Curved masonry walls.
§ 2417. Hollow walls of brick.
§ 2418. Bonding masonry.
§ 2419. Brick masonry walls.
§ 2420. Hollow units.
§ 2421. Stone ashlar facing.
§ 2422. Masonry veneer.
§ 2423. Glass veneer.
§ 2424. Thin veneer.
§ 2425. Terra cotta.
§ 2426. Joist and beam bearing.
§ 2427. Anchors.
§ 2428. Lintels, openings and recesses in walls.
§ 2429. Corbelling.
§ 2430. Cornices.
§ 2431. Wood in masonry walls.

§ 2432. Lining existing walls.
§ 2433. Parapet walls.
§ 2434. Masonry arches and domes.
§ 2435. Lateral forces.
§ 2436. Structural glass blocks.
§ 2437. Retaining walls.
§ 2438. Interior non-bearing partitions.
§ 2439. Public toilets.
§ 2440. Filing trademark for concrete products.

Sec. 2401. Masonry materials.

1. The quality of materials assembled in masonry and the method and manner of their assembly shall conform to the minimum requirements of this Part.

2. The materials entering into masonry shall be classified for the purpose of this Code as follows: brick, stone, cast stone, concrete blocks, structural clay tile, gypsum tile, plain concrete, plain gypsum concrete and mortar.

Sec. 2402. Fire protection.

Where masonry is used in fire walls, partitions and as fire protection it shall conform with the provisions of Table 1605 and as described in Part XXXVII.

Sec. 2403. Brick.

a. Clay Brick. Burned clay brick shall be either solid or hollow, but if hollow shall be at least 75 per cent solid.

b. Sand-lime Brick. Sand-lime brick shall be made of sand, lime and water well mixed, pressed and cured in a controlled process to a uniform hard and durable product.

c. Concrete Brick. Concrete brick shall be made of Portland Cement, aggregates and water. The absorption of cold water for a period of 5 hours, shall not be over 10 per cent by weight and in no individual case of more than 12 per cent. All tests shall be made upon brick 28 days old. All such units shall bear a trademark as required in Section 2440.

d. Reused Brick. All second hand brick shall be thoroughly cleaned and shall be at least as good as grade c brick.

e. Classification of Brick by Strength. For the purposes of this Code brick shall be classified as follows, all strengths being expressed in pounds per square inch.

TABLE 2402 D

Grade	Average crushing strength	Minimum strength of any one sample	Maximum water % absorption average of 5 bricks
A	4500 or over	3500	10
B	3000 or over	2500	16
C	2000 or over	1500	No limit

f. Use of Brick. Brick for load-bearing masonry or masonry exposed to the weather shall be Grade A. All other brick masonry may be of Grades B, C or better.

Sec. 2404. Stone.

1. Stone for masonry shall be hard and durable. Sandstone in masonry exposed to the weather shall be laid with its natural bed horizontal.

2. Rubble walls shall have through stones for bonding, built in at intervals of not more than 3 ft. vertically and horizontally.

Sec. 2405. Cast stone.

All cast stone shall be of a quality at least equal to the Specifications for Cast Stone (P-3-A-29T) of the American Concrete Institute.

Sec. 2406. Concrete block.

All hollow concrete units shall be of a quality at least equal to the American Society for Testing Materials "Specifications for Hollow Load-Bearing Concrete Masonry Units" (C90-39) when used for bearing walls or piers, or exposed to the weather, or equal to "Specifications for Hollow Non-Load-Bearing Concrete Masonry Units" (C129-39) when used for non-bearing purposes and not exposed to the weather.

Sec. 2407. Structural clay tile.

All hollow clay tile shall be of a quality at least equal to the American Society for Testing Materials "Specifications for Structural Clay Load-Bearing Wall Tile" (C34-39) class "LBX" when used for bearing walls or piers or exposed to the weather, or equal to "Specifications for Structural Clay Non-Load-Bearing Tile" (C56-

39) when used for non-load-bearing purposes and not exposed to the weather, or equal to "Specifications for Structural Clay Floor Tile" when used for floor construction.

Sec. 2408. Gypsum tile, mortar.

1. Gypsum tile or block used for non-bearing partitions, walls, furring and enclosures may contain, intimately mixed, not more than 12½ per cent by weight of binding material consisting of wood chips, excelsior or fiber.

2. Gypsum partition tile or block shall be equal in quality to that specified in the Standard Specifications for Gypsum Partition Tile and Block of the A. S. T. M., C52-33.

3. Gypsum as used in this Code, shall be understood to comply with the standard specification for Gypsum of the A. S. T. M., C22-25.

4. Gypsum mortar: for whatever purpose required under the provisions of this Code shall be composed of one part gypsum and not more than three parts clean, sharp, well graded sand, by weight. Mortar used for laying gypsum tile shall be gypsum mortar.

Sec. 2409. Plain concrete.

1. Plain concrete is concrete cast in place and not reinforced, or reinforced only for shrinkage or changes in temperatures. It shall be mixed, placed and cured as specified in pertinent sections of Part XXVII.

2. Plain concrete in load-bearing masonry or where exposed to water or soil or where used for fire-resistive purposes, shall be at least 1500 pounds per square in. and where exposed to wetting and freezing at least 2000 pounds per sq. in. as provided in table 2704A, Part XXVII.

3. Plain concrete shall be of the same minimum thickness as required for brick walls.

Sec. 2410. Plain gypsum concrete.

Plain gypsum concrete is gypsum concrete cast in place, whether neat or containing binder either unreinforced, or reinforced only for shrinkage and for holding in place. The use of gypsum concrete shall meet with the approval of the Superintendent.

Sec. 2411. Mortars.

a. Quality of Materials. The quality of materials used in mortars, such as lime, Portland cement, prepared masonry cements and sand shall conform with the respective standard specifications of the A. S. T. M.

b. Portland Cement Mortar.

Portland cement mortar shall consist of 1 part by volume of Portland cement and not more than 3 parts by volume of sand to which may be added a volume of hydrated lime not to exceed 15 per cent of the volume cement used or any equivalent volume of thoroughly slaked lime putty may be used in place of the hydrated lime. Portland cement mortar shall be required in the following places: for grouting column bases and beam or truss bearing plates, in isolated piers and footings. Portland cement mortar may be used wherever other mortars are required or permitted.

c. Cement-lime Mortar. 1. Cement-lime mortar shall consist of 1 part by volume of Portland cement to 1 part by volume of hydrated lime and sand equal to not more than 3 times the combined volumes of Portland cement and lime; or an equivalent volume of thoroughly slaked lime putty may be used in place of the hydrated lime.

2. Cement-lime mortar may be used in all places except where Portland cement mortar is required or is used but may be replaced with lime mortar where this is specifically approved.

d. Prepared Masonry Cement Mortar. The use of prepared masonry mortar shall conform to the requirements of the Building Superintendent.

e. Lime Mortar. 1. Lime mortar shall consist of 1 part by volume of hydrated lime and not more than 3 parts by volume of sand; or an equivalent volume of thoroughly slaked lime putty may be used in place of the hydrated lime.

2. Lime mortar shall be used only in masonry made of solid units when placed above grade and in buildings not exceeding 2½ stories high. Lime mortar shall not be used for exterior work.

3. Portland cement may be added to lime mortar replacing equal volumes of lime putty. When such addition is made the working stress may be increased proportionately up to the stress specified for cement lime mortar as stated in the table for lime cement mortar. Such mortar shall be used only in masonry made of solid units in all places except where Portland cement or cement lime mortar is required or is used, but may be replaced with lime mortar where this is specifically approved.

Sec. 2412. Safe loads for masonry.

The following average stresses in pounds per square inch of gross wall or pier area shall not be exceeded in any mass of masonry and the concentrated bearing under any column base or beam or truss bearing plate shall not exceed 1¼ times the following values:

Masonry	Portland cement mortar	Cement lime mortar	Masonry cement mortar	Lime mortar
Brick (clay, sand-lime or concrete)				
Grade A	400	320	175	100
Grade B	250	200	135	100
Grade C	170	130	100	90
Hollow Walls of Solid Masonry Units	125	100	75	50
Structural Clay Tile or Concrete Blocks	90	70	40	
Rubble Stone	120	110	80	70
Stone Ashlar:				
Sandstone	400	320	175	100
Limestone or Granite	500	400	225	150

Sec. 2413. Thickness of masonry walls.

a. General. 1. The thickness of masonry walls shall in all cases, irrespective of the requirements of this section, be sufficient to keep the stresses in the masonry within the working stresses prescribed by this Code.

2. Masonry for exterior, bearing, fire or party walls shall have the minimum thickness specified in this Section.

3. If any portion of any building is lower than the rest, the low portion may have walls of the thickness required for a building of height equal to that of the low portion.

4. For the purpose of this section a half story shall not be considered but any balcony or mezzanine floor of more than 10 ft. span shall be considered as forming a story in fixing the thickness of the walls which support it.

b. For All Public and Business Buildings.

(CLASS A, B, C, D, E, F, G AND J OCCUPANCY)

TABLE 2413 A

INTERIOR AND EXTERIOR WALLS

Allowable length 105 ft. between cross walls, piers, etc.

Stories	B	1	2	3	4	5	6	7	8	9	10	11	12
1	12	12	..	..	..	..	..	..	..	..	..	..	..
2	12	12	12	..	..	..	..	..	..	..	..	..	..
3	16	12	12	12	..	..	..	..	..	..	..	..	..
4	16	16	12	12	12	..	..	..	..	..	..	..	..
5	16	16	16	12	12	12	..	..	..	..	..	..	..
6	20	16	16	16	12	12	12	..	..	..	..	..	..
7	20	20	16	16	16	12	12	12	..	..	..	..	..
8	20	20	20	16	16	16	12	12	12	..	..	..	..

1. In a building not over one story or 12 ft. high nor more than 1000 sq. ft. in area the masonry exterior bearing walls above the foundation walls, may be 8 in. thick.

2. Non-bearing masonry walls not used for fire or party walls may be 4 in. less in thickness than required by Table 2413 A. Walls supporting stairs and stair landings only, may be less than specified, provided that no such non-bearing or stair wall shall be less than 8 in. thick nor have a greater height unstayed laterally than 30 times its thickness and not over 20 ft. long.

c. For All Residence Buildings Other than Single and Two Family.

(CLASS H, AND 1-2 OCCUPANCY)

TABLE 2413 B

Allowable length 60 ft. between cross walls, piers, etc.

Stories	B	1	2	3	4	5	6	7	8	9	10	11	12
1	12	12	..	..	..	..	..	..	..	..	..	..	..
2	12	12	12	..	..	..	..	..	..	..	..	..	..
3	12	12	12	12	..	..	..	..	..	..	..	..	..
4	12	12	12	12	12	..	..	..	..	..	..	..	..
5	16	12	12	12	12	12	..	..	..	..	..	..	..
6	16	16	12	12	12	12	12	..	..	..	..	..	..
7	16	16	16	12	12	12	12	12	..	..	..	..	..
8	20	16	16	16	12	12	12	12	12	..	..	..	..

1. If the roof frame is of flat construction, the walls of the top story may be 8 in. thick, for buildings 3 stories or less in height.

d. For Single, Two-Family Dwellings, Semi-Detached Dwellings and Group Dwellings.

(CLASS 1-1 OCCUPANCY)

TABLE 2413 C

	Exterior walls				Party walls, Fire walls, Bearing walls			
	B'm't	1	2	3	B'm't	1	2	3
1 and 2 story buildings	12	8	8		12	8	8	
2½ story buildings	12	8	8		12	8	8	
3 story buildings	12	12	8	8	12	12	8	8

1. Providing, however, that wooden floor beams resting on both sides of an 8 in. solid masonry wall shall be staggered so there will be at least 4 in. of masonry between joists and at end of joists. Such beams may be supported on metal hangers.

e. Additional Provisions. 1. Every wall over 105 ft. long without a cross wall shall be increased 4 inches in thickness or provided with pilasters 4 inches thick and having a width of at least 1/10 of their center to center spacing. In determining the length of a wall for the purpose of this Section, the length shall be terminated by any solid masonry pier not less than twice the wall thickness in width and three times the wall thickness in length or by any break or cross wall supported at both ends by masonry walls and having a length of at least ¼ of the height of the wall and extending the entire height of the wall.

2. No masonry wall shall have a maximum height between horizontal lateral supports of more than 22 times its thickness unless buttresses having a thickness of not less than 1/17 of the maximum height of wall and a width of not less than 1/10 of the center to center spacing are provided. Such buttresses shall be fully bonded to wall and the clear distance between them shall not exceed 20 times the thickness of the panel wall.

3. Where the clear span between walls carrying joists, rafters or slabs exceeds 30′ such walls shall be increased 4 inches in thickness for each 12½ feet or part thereof that such span exceeds 30 feet unless adequately reinforced by proper pilasters, buttresses or columns.

4. Curtain walls between columns, buttresses or projecting piers may be thinner than required by preceding tables: provided, however, that in dwellings not over three stories high such curtain walls

shall not be less than 4 inches thick and in all other buildings such curtain walls shall not be less than 12 inches thick for party walls not less than 8 inches thick for exterior walls, except that the portion between the top of one window opening and the bottom of the window opening above, if faced with metal, shall be backed by at least 4 inches of incombustible material.

5. Curtain walls in buildings of skeleton construction shall be securely anchored to the frame at each floor level. No curtain wall exceeding 20 ft. in length shall have a greater height unstayed laterally than 30 times its thickness.

Sec. 2414. Workmanship and weather.

1. All masonry shall be built straight, true and plumb. The work shall be performed in a workmanlike manner. Masonry walls and piers shall be erected to the exact height required to support joists, beams and girders without shims or blocking.

2. During freezing weather all masonry material shall be free from frost before using; all work shall be adequately protected to prevent freezing before mortar has attained final set. In no case shall any masonry wall of a building be erected more than one story in advance of any other wall with which it is to be joined or connected.

Sec. 2415. Piers.

Masonry piers shall not have a free standing height of more than 12 times their least dimension. Any facing of stone, face brick or other materials not fully bonded with masonry headers shall not be considered as a part of the pier. All piers shall be loaded within the center third. Piers less than 2 feet in their greatest dimension shall not be constructed with hollow units except when constructed of especially designed pier blocks or tiles

Sec. 2416. Curved masonry walls.

Curved masonry walls shall not be used for supporting heavy loads and no arched openings shall be provided in such walls unless relieved by adequate steel or concrete supports above. All such walls shall be of such thickness as the Superintendent may require and shall be provided with foundations figured for a soil bearing of not over 2/3 of the unit values used for foundations under other walls in the same building. The tops of such walls shall be adequately tied to the interior of the building with steel or reinforced concrete ties to effectively prevent any outward thrust of the wall.

Sec. 2417. Hollow walls of brick.

Brick walls with air spaces shall contain, exclusive of bonding bricks, the same amount of material as required for solid walls, and the wall inside of the air space supporting more than two floors shall be not less than 8 in. thick. The double walls shall be headed over for at least 2 courses below all floor or roof beams and shall be bonded throughout the wall by brick or non-ferous metal ties approved by the Superintendent not more than 2 ft. apart vertically and horizontally.

Sec. 2418. Bonding masonry.

1. Any masonry facing or lining 4 or more inches thick, erected at the time the wall or pier is erected and bonded thereto as required in this section, shall be considered as a part of the effective thickness of the wall or pier. Any masonry facing or lining less than 4 inches thick or not so bonded shall be considered as a veneer and shall not be considered as any part of the required thickness of the wall or pier and shall not be assumed to carry any load.

2. All walls meeting at an angle shall be securely bonded to each other, or, if one wall is built in advance of the other, shall be united by proper bonding and at intervals of 5 ft. by metal anchors of a type approved by the Superintendent built into one wall to at least half the thickness of the wall and into the side or partition wall not less than 2 ft.

Sec. 2419. Brick masonry walls.

Brick walls shall be laid with full mortar joints and shall be bonded at least every 8th course by an all header or alternate header course. Blind, split or diagonal headers and metal ties shall not be accepted as fulfilling the requirements of bonding.

Sec. 2420. Hollow units.

a. General. Running bond shall be provided by projecting the units of each vertical course not less than 4 inches beyond the unit below, but in all cases the units shall be so placed as to produce vertical alignment of vertical webs when cells are vertical. When two or more units are used in the thickness of the wall, cross bond shall be provided by offsetting each alternate course by at least 4 inches, and in all cases vertical webs shall be in vertical alignment both in end and side construction, except in non-bearing walls. Buttresses, cross walls and intersecting walls, except non-bearing partitions, shall be fully bonded by projecting each second stretcher course across the plane of intersection by at least 4 inches. Concrete blocks may be broken to make closure units, but structural clay tile units shall not be broken for this purpose unless units are especially made for breaking.

b. Bearing on Hollow Units. Under all beams, girders, trusses or other concentrated loads, there shall be not less than 4 inches of solid masonry, or more if necessary to distribute the load. Drawings shall provide a detailed description of such bearing areas.

Sec. 2421. Stone ashlar facing.

1. Stone ashlar facing for walls shall be bonded by making at least 25 per cent of the wall area of stones at least 4 inches thicker than the remainder. These bond stones shall be uniformly distributed throughout the wall and in addition rust proof iron or steel anchors at least 1 in. by 3/16 in. and 8 inches long shall be provided to bond all stones exceeding ½ square foot in area on all horizontal courses not adjacent to a bond stone. Each end of anchor shall be completely imbedded in mortar. For all stones over 2 ft. in length or 4 square feet in area there shall be 2 such anchors. Stones 12 square feet in area or more shall have at least one such anchor for each 4 square feet of area.

2. Stone ashlar facing for piers shall be bonded by making each alternate course of stone at least 4 inches thicker than the remainder of the wall. The area of such bond stones shall not be less than 33 per cent of the total area of the face of the pier.

Sec. 2422. Masonry veneer.

a. General. Masonry veneer supported on masonry, steel or concrete shall be permitted if meeting the requirement of this section, but such veneer shall not be considered as carrying any load except its own weight and the thickness of such veneer shall not be counted as any part of the required thickness of any masonry wall or pier.

b. On Frame Buildings. Frame buildings supported on foundation walls at least 12 inches thick may be veneered with not less than 4 inches of masonry attached to the frame of the building with rust proof metal ties placed not over 16 inches on center horizontally and vertically. Such veneer shall not exceed 20 feet in height, but gable ends not exceeding 6 feet in average height may be veneered in addition to this 20 feet. All lintels over openings shall be of steel or reinforced concrete but limestone lintels may also be used if the calculated fibre stress in bending does not exceed 100 pounds per square inch. Ties shall be of non-ferrous material as approved by the Superintendent.

c. On Masonry Walls. Masonry walls extending more than 20 feet above the grade may be veneered with masonry facings if such veneer facing is supported at intervals of not exceeding 14 feet vertically on the frame of the building or upon steel shelf angles. All such veneers shall be anchored to the backing masonry with rust proof iron or steel anchors at least 1 inch by ⅛ inch by 8 inches or other anchor of equivalent cross-section area. At least one such anchor shall be provided for each 3 square feet of wall area, so distributed as to give the most effective bond. All such veneers shall be 4 inches or more in thickness except spandrels above windows and panels not exceeding 3 feet in either dimension which may be not less than 3 inches in thickness.

Sec. 2423. Glass veneer.

a. Backing. Glass veneers shall be installed on substantial, rigid, incombustible surfaces of true plane, plumb and straight. In no case shall the backing provide less rigidity and stability than that provided by 1 in. of cement plaster on galvanized metal lath secured to studs spaced not more than 12 in. on centers. Studs may be of wood. Wood backing surfaces are forbidden regardless of whether they are fireproofed.

b. Thickness and Size of Glass Veneers. The minimum thickness of glass veneer shall be 11/32 of an inch, except that it shall be at least 7/16 in. thick for a height of 4″ above the finished sidewalk. The maximum area of a single section of glass veneer shall not exceed 10 square feet, when not more than 15 feet above the level of the sidewalk, and shall not exceed 6 square feet when more than 15 feet above the level of the sidewalk directly below. The maximum length of any section of glass veneer shall be 4 feet.

c. Setting. Backing must be thoroughly dry and an approved bond coat applied with a 100% coverage to effectively seal the surface of the backing. Glass to be set in place with an approved mastic cement, in sufficient quantities to insure at least a 60% coverage after the glass is in place. Bond coat and mastic to be from the same manufacturer.

d. Sidewalk Line. Where glass extends to sidewalk surface, each such section shall rest in an approved metal moulding, set at least ¼″ above the highest point of the sidewalk. The space under this moulding to be thoroughly caulked and made watertight.

e. Bulkhead. Where the glass between the sidewalk line and the sill of the show window is over 26″ high, the glass shall contain at least one horizontal joint between the top and bottom edge. In no case shall glass be set so as to extend below the level of the sidewalk.

f. Terminations. Metal members shall be used at extreme ends where installations abut adjacent property and also at top to form a drip mould. All metal and glass to be caulked watertight. Where glass is confined between non-resilient materials at ends, expansion shall be provided for by means of an expansion joint at each end of not less than ¼″ throughout the entire height of installation.

g. Joints. All abutting edges on plane face of glass shall be ground square. Mitres are prohibited except for wide angles. All joints shall be uniformly buttered with an approved pointing compound and shall be held to not less than 1/16 inch by an approved non-rigid substance or device except where continuous metal ties are used in horizontal joints.

h. Mechanical Fastening. Where glass is applied at an elevation higher than the lintel sash, the mastic cement shall be supplemented by the use of fastenings, on each vertical or horizontal edge of each section of glass. Such fastenings shall be continuous and shall be of non-ferrous metal and not be less than No. 18 U. S. Gauge. Fastenings shall be so designed as to furnish bearing support and also hold the veneer in a vertical plane independently of the mastic cement. All such fastenings to be secured to the backing by means of lead anchors or toggle bolts. Continuous fastening members must be secured to the backing at least every 30 inches.

Sec. 2424. Thin veneer.

a. General. The permissible materials are marble, natural stone, cast stone, slate, terra-cotta, metal tile, precast terrazzo, tile or ceramic units, synthetic plasters and similar materials. Units less than 36 square inches in area shall be not less than ¼ of an inch thick;

and units over 36 square inches in area shall be not less than ½ inch thick. All units shall have finished or ground edges. Glazed or polished materials shall be free from all semblance of glaze or polish on the back or bonding faces. The maximum area of a single unit shall be 10 square feet when less than 15 feet above the sidewalk; and 6 square feet when more than 15 feet above the sidewalk. The maximum length of any one unit shall be 4 feet.

b. Backing, Anchorage and Support. All units shall be installed on substantial, rigid, incombustible surfaces of true plane, plumb and straight. In no case shall the backing provide less rigidity and stability than that provided by 1 inch of cement plaster on galvanized metal lath secured to studs spaced not more than 12 inches on centers. Studs may be of wood. Wood backing surfaces are forbidden regardless of whether they are fireproofed. All units shall be anchored and supported to the backing with non-rusting anchors and supports in a manner satisfactory to the Superintendent.

c. Sidewalk Line. 1. Where exterior veneer extends to the sidewalk, it shall rest on cushions of approved resilient material so placed as to insure at least ¼ inch clearance above the sidewalk. The joints between the veneer and the sidewalk shall be caulked with a waterproof compound.

2. In no case shall exterior veneer be set so as to extend below the level of the sidewalk. In case the sidewalk is placed above the bottom of exterior veneer after the veneer is in place, an expansion joint of no less width than ¼ inch shall be provided between the face of the veneer and the edge of the sidewalk. This expansion joint shall be filled with a resilient caulking compound to a depth of at least ¾ of an inch below the sidewalk level.

d. Termination. 1. Where exterior veneer is confined between non-resilient materials at the ends, an expansion joint shall be provided at each end throughout the entire height of the veneer.

2. At the terminations of exterior veneer installations, exposed edges shall be flashed water tight with approved metal and caulked with waterproof compound.

Sec. 2425. Terra cotta.

1. Where terra cotta facing is used for masonry walls, it shall be thoroughly bonded to remainder of wall with continuous solid masonry bond of solid masonry units with full header courses every 12 inches in height. In non-bearing walls hollow units may be used for backing up terra cotta, providing the size of the units is

such that anchors are properly imbedded in mortar. All open back terra cotta shall be filled solid with masonry and bonded to wall. The backing of terra cotta facing shall be done entirely with solid masonry units unless the wall thickness exceeds 8 inches, in which case the outer 8 inches shall be built up of solid masonry units in conjunction with the terra cotta as specified above and the remainder of wall may have hollow masonry units incorporated therein, if bonded to the remainder of the wall.

2. No course of terra cotta shall exceed in height 6 times its bed and all hollows for the full extent of bearing shall be filled in completely with solid masonry units. In laying terra cotta facing and blocks, all joints, cells and voids shall be well filled with mortar and the joints of one course shall break joints with the joints of the next course below, and vertical webs shall be laid directly one above the other, except that for ornamental effects joints may be made continuous for not more than 5 courses.

3. The terra cotta facing shall not be considered as supporting any load and shall not be included as part of the required thickness of the wall.

Sec. 2426. Joist and beam bearing.

Wood or steel joist and lintels shall have a bearing of not less than 4 inches on masonry walls. Beams and girders shall have a bearing of at least 6 inches and trusses of at least 8 inches. In all cases the bearing shall be sufficient to distribute the stress so that no concentrated bearing stress shall exceed the values permitted in Section 2412. When necessary to properly distribute loads, steel bearing plates or grillages shall be provided and accurately bedded in a level position with Portland cement mortar. The walls of each story shall be carried full thickness to the top of the beams.

Sec. 2427. Anchors.

1. All walls shall be anchored to the floor construction, and to the roof construction where parapet walls occur, by metal anchors of type approved by the Superintendent, at intervals of not more than 6 ft. for walls supporting floor beams or slabs and to girders and partition caps, and at intervals of not more than 8 ft. for walls parallel to wooden or steel floor beams. In the latter case the anchor shall engage at least 2 joists.

2. Wood and steel girders and trusses shall be attached to ma-

sonry walls and piers with similar anchors or with substantial anchor bolts, which shall be bedded solid in masonry.

3. Steel joists shall be anchored with a ⅜ inch round anchor attached to each second joist and bedded solid in masonry, but such anchors shall not be more than 6 feet apart.

Sec. 2428. Lintels, openings and recesses in walls.

a. Lintels. All horizontal openings shall be bridged at top by steel or reinforced concrete, reinforced masonry lintels or reinforced structural clay tile lintels or masonry arches. Such lintels and arches shall be designed to take the entire load of floors, joists, girders and other members immediately above opening and all of the load from masonry or other sources included within two lines starting from the supports of the lintel or arch and rising at an angle of 60 degrees, with the horizontal. Steel lintels need not be fireproof if opening does not exceed 8 ft. or if the member so unprotected is supported at intervals not exceeding 8 ft. Arches shall only be used where there are adequate abutments or where tie rods are used and shall not be used when intersected by wood joists or girders.

b. Chases, Recess. Unless otherwise specifically provided in this Part, no chase or recess shall be built or cut in any bearing or fire wall so as to reduce the thickness to less than 8 inches, and no chase shall be more than 4″ x 8″, or spaced less than 20′-0″ O. C. or be built or cut in any wall so as to materially reduce its strength. No chase shall be cut into any wall constructed of hollow units after it is built so as to materially impair its strength unless the broken units are removed and the wall properly rebuilt with solid units or concrete.

Sec. 2429. Corbelling.

Corbels may be built on walls not less than 12 inches thick to an amount not exceeding 1/3 of the thickness of the wall. The projection of any course beyond the course below shall not exceed 1 inch. No corbelling of concrete blocks or structural clay tile shall be permitted.

Sec. 2430. Cornices.

Terra cotta, stone or other masonry cornices may project as permitted in Part XXXI and shall be so designed that 2/3 of the weight shall be inside of the outer edge of the supporting masonry wall or other supporting member unless cornice is adequately supported by a steel or concrete frame. Where blocks are used, each block shall be tied to the backing near the top with at least 2 anchors, and the top of such cornices shall be made water tight with copper coping or other equally effective means.

Sec. 2431. Wood in masonry walls.

1. No timber or other combustible material shall be used to support any masonry wall.

2. Wood blocks for nailing purposes of a size not exceeding 4″ x 8″ x 3″ may be built into any wall. Strips of wood not over ½ inch thick by 1⅝″ wide for attachment of furring may also be built into walls. Such strips and blocks shall be set dry without mortar bed top or bottom and in walls of concrete block or tile, or clay tile laid with cells vertical, they shall be built only into vertical joints. Nailing blocks of a size not exceeding 4″ x 8″ x 3″ made of hard, durable incombustible inorganic material may also be built into masonry walls.

3. Wooden floor and roof beams entering the same fire or party wall from opposite sides shall have at least 4 in. of masonry between their ends in any direction, except in case of 8 in. walls, when there must be 4 in. of masonry between beams and at ends of beams.

Sec. 2432. Lining existing walls.

1. In case it is desired to increase the height of existing walls which are less in thickness than required under this code, the same shall be done by a lining of masonry to form a combined thickness with the old wall of not less than 4 inches more than the thickness required for a new wall under this code. The new lining shall be supported on proper foundations.

2. No lining shall be less than 8 inches in thickness and shall be bonded to the old wall with masonry headers at least every 3 ft. vertically and horizontally.

Sec. 2433. Parapet walls.

For all buildings which have roofs sloping less than 4 inches per ft., all party, fire, and exterior walls less than 5 feet from adjoining lot lines, except where such walls are finished with gutters, crown moulds, or cornices, shall have parapet walls of the same thickness as the walls below but shall not be required to be more than 12 in. thick. In buildings less than 45 ft. high the parapet shall be at least 12 in.

high above roof covering, and in all other buildings the parapet shall be 2 ft. 6 in. high at least: provided, however, that in first-class buildings the fire walls need not extend above the roof.

Sec. 2434. Masonry arches and domes.

1. Masonry arches shall be so designed that the line of thrust under all loadings lies within the middle third of the structural arch, or arch ring. Abutments shall be provided capable of resisting the horizontal as well as the vertical component of the thrust without settlement which would permit the line of thrust to depart from the middle third of the arch ring.

2. The horizontal component of the arch thrust may be resisted by metal ties so placed that the horizontal component furnished by the ties, combined with the vertical supporting reaction shall be in line with the arch thrust.

3. Timbrel arches and domes, built of overlapping tiles in two or more layers, shall be used as approved by the Superintendent.

Sec. 2435. Lateral forces.

Lateral thrusts from roof rafters or other construction shall not be resisted by masonry walls, unless a rational analysis according to established principles of mechanics proves the stresses to be within those specified in Section 2412 or unless special provision is made by means of reinforcement, buttresses, piers, or ties.

Sec. 2436. Structural glass blocks.

a. General. The minimum overall thickness of all blocks through the mortar joint shall be 3¾ inches. All mortar surfaces shall have satisfactory alkali and moisture resistant, adhesive and bonding properties.

b. Where They May Be Used. Glass blocks may be used in such walls and locations, where unwired plain glass is permissible. Glass block panels shall not carry any live or dead loads.

c. Mortar. 1. Mortar shall be of no less strength than 1 part Portland cement, 1 part lime putty and 6 parts clean sharp sand.

2. Mortar for exterior glass block panels shall contain an integral metallic stearate type of waterproofing, which is to be added at the time the mortar is mixed.

d. Joints. 1. All mortar joints shall be completely filled with mortar; and the mortar shall be compressed on both surfaces of the wall with a pointing tool after it has reached its initial set.

2. Extruded non-ferrous metal members may be used in place of mortar, for interior work, when approved by the Superintendent.

e. Joint Reinforcement. Metal reinforcement shall be installed in horizontal mortar joints of all glass block panels as follows:

For 5¾″ size Blocks—Every four courses
For 7¾″ size Blocks—Every three courses
For 11¾″ size Blocks—Every course

The reinforcement shall run continuously with ends lapped not less than 6 inches and shall run from end to end of panel, completely imbedded in mortar. The reinforcement shall not bridge expansion joints and shall be galvanized and may be of the following types:

2″ wide steel double wire mesh formed of two parallel wires (.150″ in diameter) with electrically welded cross wires (.105″ in diameter) at regular intervals—or No. 20 gauge steel expanded metal 2⅜″ wide—or No. 20 gauge steel strips 1¾″ wide with rectangular slots.

f. Anchorage and Size of Panels. 1. Moderate size panels which are not supported in chases shall be anchored to the adjoining masonry by means of perforated 20 gauge steel anchors 1¾″ wide by 24 inches long, galvanized after forming: or by other approved means.

2. When wall anchors are used, they shall be inserted in the glass block joints and shall extend into the masonry at least 12 inches, or be securely fastened to the masonry. Such anchorage shall be bent at the jambs to allow for expansion.

3. For panels, whose least dimension is 6 feet or less, lateral support need be provided only along both jambs or along the sill and head; provided that such support shall always occur along the longer dimension.

4. Large panels shall be anchored at the heads or/and sill, and jambs by approved mechanical means, such as being inserted between metal channels or built up sections, or masonry-chases, except that blocks shall not be placed in chases, grooves or slots built in sills.

5. Panels of glass block construction shall not exceed 144 sq. ft. of area of wall surface or shall not exceed 20 lineal feet in one dimension, between lateral structural supports. Nothing in this section shall prevent the use of a continuous series of panels of glass block construction either vertically or horizontally, provided the above defined panel dimensions are not exceeded between vertical or horizontal structural supports.

6. The four edges of panels of glass block construction in a continuous series shall be supported by inserting the glass blocks in masonry or structural steel chases, or by other approved means, so spaced that the 144 square feet panel size is not exceeded, and so designed as to resist wind loads.

g. Expansion Joints. Glass block construction shall be adequately protected from the forces caused by expansion, contraction and warping of abutting materials by properly designed expansion joints. Expansion joints shall be provided at jambs and heads of all glass block panels and at intervals that do not exceed 20 feet in a continuous series of panels. Expansion joints shall consist of packed oakum, or similar resilient material, pointed on both sides with not less than ¼ of an inch on non-hardening waterproof caulking material. Sills shall be painted with emulsified asphalt before mortar joints are laid under the first course. The depth of all expansion joints shall be not less than ½ inch. All expansion joints shall be kept free of mortar.

Sec. 2437. Retaining walls.

Every masonry wall supporting or retaining earth, coal, sand or other loose material, whether it extends above the grade or whether it is below grade and supports joists, floor slabs or other loads above, shall be considered a retaining wall and shall have a thickness at any point sufficient to prevent tension in mortar joints. Free standing walls shall be designed for stability without relying on tension in mortar.

Sec. 2438. Interior non-bearing partitions.

a. Masonry. 1. Incombustible non-bearing interior partitions may be built of the following units: brick, structural clay tile, concrete blocks or tile, cinder, sand lime brick, concrete brick, cork concrete brick, gypsum or other similar incombustible material approved for this use by the Superintendent. Such units shall be strong enough for the purpose for which they are to be used. Such partitions shall not exceed the following heights:

2¼″	partitions of masonry, plastered both sides	8′-0″*
3″	partitions of masonry, plastered one side	10′-0″
*3¾″	partitions of masonry, not plastered	12′-0″
5″	partitions of masonry	16′-0″

* Length not to exceed 10′-0″.

2. Such partitions shall be securely anchored and wedged to floor, roof, columns and wall construction to provide adequate lateral stiffness and support. Lintels in partition walls shall be of metal or masonry.

b. Metal. Incombustible non-bearing partitions may also be constructed of a combination of metal lath and plaster on metal studs or ⅜ inch gypsum lath and gypsum plaster supported on metal studs, the gypsum lath to contain not over 6 per cent fibre, or similar material approved by the Superintendent. Metal lath must be given a scratch coat and pressed through the lath to insure a perfect key. Scratch coat must be thoroughly set before brown or base coat is applied. Such partitions shall not be less than 2 inches thick if solid or 3 inches thick if hollow. Such partitions if over 12 feet high shall be increased in thickness as provided below and all such partitions shall have studs equivalent in strength to cold rolled channels of the following depth spaced not over 24 inches on centers.

Maximum Height of Partition	Thickness in Inches	Depth of Channel Stud
12 feet	2″	¾″
14 feet	2¼″	¾″
16 feet	2¼″	1″
18 feet	2½″	1″

Sec. 2439. Public toilets.

1. All toilets that are accessible to the "Public" shall be provided with impervious, hard, wear-resisting, sanitary floors and wainscots; the wainscots to extend at least 4 feet above the finished floors.

2. For wainscots—marble, natural stone, cast stone, terrazzo, structural glass, metal tile, slate, blue-stone, soap-stone and ceramic or ceramic mosaic products (the ceramic products to be vitrified if unglazed, and semi-vitreous if glazed).

3. Partitions and stiles shall consist of incombustible, hard, sanitary materials.

Sec. 2440. Filing trademark for concrete products.

1. All manufactured concrete units as such, concrete blocks, concrete brick, cinder concrete block and other similar masonry units must bear a trademark. Such trademark shall be filed with the Building Department prior to the manufacture of any such unit that may be used in the City of Cambridge. Any subsequent change of the trademark shall be filed as above.

2. The Superintendent shall have the power to demand that a test be made at the expense of the manufacturer of the concrete blocks on each and every job when such units do not carry a distinctive trademark identifying the manufacturer.

PART XXV.

Wood Construction.

§ 2501. Quality and design.
§ 2502. Notation of plans.
§ 2503. Lumber sizes and grades.
§ 2504. Allowable unit stresses.
§ 2505. Vertical members.
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§ 2507. Stud walls and partitions.
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§ 2510. Framing details; trusses.
§ 2511. Fire stopping.
§ 2512. Roof covering.
§ 2513. Miscellaneous wood frame structures.

Sec. 2501. Quality and design.

1. The quality and design of all wood used in the construction of buildings, parts of buildings, or structures shall conform at least to the minimum standards specified in this part.

2. All members shall be so framed, anchored, tied and braced together as to develop the maximum strength and rigidity necessary for the proposed use. No member shall be stressed in excess of the strength of its details and connections.

3. Workmanship in fabrication, preparation and installation of materials shall conform throughout to good engineering practice.

Sec. 2502. Notation on plans.

The species, classification and grade of all wood used structurally shall be specified on the plans filed with the Superintendent.

Sec. 2503. Lumber sizes and grades.

The minimum sizes of wooden members specified in this part are net sizes; for convenience nominal sizes may be used on plans submitted with applications to the Superintendent for permit. American Lumber Standard dressed sizes shall be accepted as the minimum net sizes conforming to corresponding nominal sizes of lumber, and these net sizes shall be used in computations for stress unless other finished sizes are to be used and are so specified on the plans.

Sec. 2504. Allowable unit stresses.

1. Stress due to dead and live loads acting singly or in combination, without wind load, or other lateral load, shall not exceed the allowable stresses hereinafter specified. For stresses produced by wind loads or by a combination of wind loads and dead live loads the working stresses allowed in Tables 2504A and 2504B may be increased 33 1/3 per cent, provided the resulting sections are not less than those required for dead and live loads alone.

2. In joists supported on a ribbon or ledger board and spiked to the studs, the allowable unit stress in compression across the grain may exceed the allowable stress specified in Table 2504A by not more than 50 per cent.

3. The restrictions and limitations of the two preceding paragraphs apply to all timber buildings in which the lumber is in a dry location and not exposed to the weather. Timbers exposed to the weather shall be designed on a basis of working stresses 25 per cent lower than those specified in Table 2504A.

4. For direct tension the values given for extreme fibre bending stress may be used.

5. Southern yellow pine for both dense and sound grades shall have defects restricted in accordance with specifications promulgated by the Superintendent, or, in the absence of such specifications, in accordance with the section on defects in the rules of the Southern Pine Association for Select Structural Material.

6. Timber compression members shall not have knots greater in

TABLE 2504A.

STRUCTURAL WOOD.

(Allowable unit stress—pounds per square inch.)

Species	Grade	Bending	Shear	Compression across Grain	Modulus of Elasticity
Cypress, Red	Select structural	1300	100	300	1,200,000
	Common structural	1040	80	300	1,200,000
Douglas Fir (Coast Region)	Dense select structural	1800	120	380	1,600,000
	Select structural	1600	100	345	1,600,000
	Common structural*	1200	100	325	1,600,000
Douglas Fir (Inland)	Select structural	1800	120	380	1,600,000
	Structural	1600	85	335	1,500,000
	Common structural	1200	80	315	1,500,000
Hemlock (Eastern)	Select structural	1100	70	300	1,100,000
	No. 1 joists and timbers	880	55	300	1,100,000
Hemlock (West Coast)	Common structural*	1040	100	300	1,400,000
Larch	Select structural	1800	130	380	1,300,000
	Structural	1600	100	345	1,300,000
	Common structural	1200	90	325	1,300,000
Oak	Select dimension	1400	125	500	1,500,000
	Common dimension	1100	100	500	1,500,000
Pine, Longleaf Southern Yellow	Select structural	2000	125	375	1,600,000
	Prime structural	1800	125	375	1,600,000
	Merchantable structural	1600	125	375	1,600,000
	No. 1 structural	1400	125	375	1,600,000
Pine, Dense, Shortleaf Southern Yellow	Select structural	2000	125	375	1,600,000
	Structural	1800	125	375	1,600,000
	Structural square edge and sound	1600	125	375	1,600,000
	No. 1 structural	1200	125	375	1,600,000
Pine, Norway	Select structural	1100	85	300	1,200,000
	Common structural	880	65	300	1,200,000
Red Cedar (Western)	Structural	1000	100	200	1,000,000
Redwood	Prime structural	1500	80	250	1,200,000
	Select structural	1250	70	250	1,200,000
	Heart structural	1000	55	250	1,200,000
Spruce (Eastern)	Common structural (merchantable)	1000	65	300	1,200,000

*No. 1 dimension, with slope of grain not more than one in ten.

TABLE 2504B.

AVERAGE UNIT COMPRESSION IN WOODEN COLUMNS FOR GIVEN RATIO OF LENGTH TO LEAST DIMENSION.

Species	Grade	Slenderness Ratio L/D										
		11 or less	14	17	20	23	26	29	32	35	40	50
Cypress, Red (Tidewater)	Select S	1100	1030	948	810	622	486	391	321	268	206	132
	Common S	880	843	801	729	620	486	391	321	268	206	132
Douglas Fir (Coast Region)	Dense Select S	1300	1235	1158	1030	828	649	521	428	358	274	175
	Select S	1200	1148	1088	988	828	649	521	428	358	274	175
	Common S No. 1 dimension	1100	1060	1015	937	811	649	521	428	358	274	175
Douglas Fir (Inland)	Select S	1466	1372	1264	1079	828	649	521	428	358	274	175
	S	1175	1120	1056	947	776	608	489	401	336	257	154
	Common S	1050	1011	965	887	784	608	489	401	336	257	164
Hemlock (Eastern)	Select S	700	678	653	611	544	446	358	294	246	188	121
	No. 1 joists and timbers	560	549	536	515	480	430	358	294	246	188	121
Hemlock (West Coast)	Common S No. 1 dimension	720	706	688	660	615	549	456	375	313	240	153
Larch	Select S	1466	1325	1160	877	673	527	424	348	291	223	142
	S	1200	1122	1032	877	673	527	424	348	291	223	142
	Common S	1100	1041	970	851	673	527	424	348	291	223	142
Oak	Select dimension	1000	967	927	860	755	608	489	401	336	257	164
	Common dimension	800	783	762	728	674	595	489	401	336	257	164
Pine, Longleaf Southern Yellow	Select S	1450	1360	1254	1074	828	649	521	428	358	274	175
	Prime S	1300	1235	1158	1030	828	649	521	428	358	274	175
	Merchantable S	1200	1148	1088	988	828	649	521	428	358	274	175
	No. 1 S	1000	971	936	878	786	649	521	428	358	274	175
Pine, Dense Shortleaf Southern Yellow	Select S	1450	1360	1254	1074	828	649	521	428	358	274	175
	S	1300	1235	1158	1030	828	649	521	428	358	274	175
	S square edge and sound	1200	1148	1088	988	828	649	521	428	358	274	175
	No. 1 S	850	832	810	774	717	633	521	428	358	274	175
Pine, Norway	Select S	800	774	742	688	604	486	391	321	268	206	132
	Common S	640	627	610	582	540	476	391	321	268	206	132
Red Cedar (Western)	S	880	808	676	664	537	405	304	256	223	170	109
Redwood	Prime S	1245	1143	1023	822	622	486	391	321	268	206	132
	Select S	1100	1030	948	810	622	486	391	321	268	206	132
	Heart S	1000	947	886	781	622	486	391	321	268	206	132
Spruce (Eastern)	Common S (merchantable)	640	627	610	582	540	476	391	321	268	206	132

Note: S = Structural.

diameter than 1/3 the least dimension of the member or 4 in. in any case.

7. Structural, or load-bearing lumber in buildings or other structures shall be of the grades listed in Tables 2504A and 2504B for the several species except that number one and number two common yard grades of dimension lumber may be used for formwork, temporary purposes, boarding on joists or studs closely spaced, studs in non-bearing partitions, ceiling joists; and in buildings for rafters, floor joists and studs where the live load does not exceed 40 lbs. per sq. ft. The unit stress in lumber of such common yard grade shall not exceed the following percentages of the corresponding stress for the lowest grade listed in the tables for the same species.

PERCENTAGE UNIT STRESSES IN COMMON YARD LUMBER.

	Bending	Shear	Compression Across Grain	Modulus of Elasticity	Columns
No. 1 common	90	85	90	100	85
No. 2 common	65	85	90	100	65

8. Timber compression members shall not be used for a greater unstayed length than 30 times their least dimension for isolated columns or 50 times their least dimension for columns in partitions or truss members. The stresses due to eccentric or transverse loading combined with those due to central loading shall not exceed the maximum stress allowed in Table 2504B.

Sec. 2505. Vertical members.

1. Wood columns and posts shall be squared at the ends; shall be provided with base plates and dowels; shall be superimposed on approved metal appliances where continuing through more than one story; shall not rest directly or indirectly on any floor beams, except in case there is no column below.

2. Wood bolsters may be used to support a single floor or the roof beams only.

3. Preservatives shall be applied to column ends where necessary to protect against possible dampness.

4. No wooden post or column shall be used in basement or cellars for any type of construction.

Sec. 2506. Horizontal members.

a. Girders, Beams in Masonry Walls. Girders and beams where entering or resting on masonry walls shall have a bearing of at least 6 inches.

b. Girders, Beams at Columns. Where members meet at columns they shall be fitted around the column or butted up close to it and held in place by metal straps unless the post caps provide sufficient anchorage.

c. Wood Members in Fire or Party Walls. Wood members entering masonry, party or fire walls shall be separated from the opposite side of the wall and from beams entering the opposite side of the wall by at least 4 inches of masonry. The ends of the joists, beams and/or girders shall be fire-cut to a bevel of not less than 3 inches in their depth.

d. Wood in Masonry Walls. No timbers except lintels as provided for in this paragraph and nailing blocks not exceeding 2 x 4 x 8 ins. in size shall be placed in or under any masonry wall. Wood lintels placed inside of a wall above which brick arches are turned shall be permitted only in buildings of Types 4 and 6 construction. The span of such lintels shall in no case exceed 6 feet.

e. Anchors. The first floor joists whose bearing is more than 5 ft. above the adjacent finished ground line shall be provided with anchors where they enter masonry walls and also when they are parallel to masonry walls. Such anchors shall be not less than 1¼ ins. x ¼ in. securely fastened at the bottom of joists and imbedded in masonry and mortar. Larger size anchors shall be provided when required by the Superintendent, shall be securely fastened to joists, spaced not more than 6 ft. apart and imbedded solidly in masonry and mortar. Anchors shall in all cases occur in opposite ends of the same run of joists and ends of joists shall be lapped and spiked so as to form a continuous tie across the building. Anchors shall be placed across the top of joist that run parallel to the wall.

f. Joist Support. Floor joists shall be supported by girders, bearing partitions or exterior walls. Where entering stud walls, the joists shall be supported by a ribbon let into the studs if no plate or girt is provided. Joists shall be well nailed to the supporting studs.

g. Joist Hangers. Header joists over 6 ft. long and tail joists over 12 ft. long shall be hung in approved stirrup irons or joist hangers.

h. Joists Doubled under Partitions. Joists under partitions and running parallel thereto shall be doubled and well spiked or separated by solid bridging not more than 16 in. on centers, such doubling of joist shall be considered the minimum. Where necessary heavier members shall be provided.

i. Wood Bridging. Wood cross bridging shall be placed between joists if the span is over 8 ft. The distance between bridging or between bridging and bearing shall not exceed 8 ft. Wood cross bridging in dwellings may be 3 sq. in. in cross sectional area, but in other buildings shall be not less than 6 sq. in.

j. Metal Bridging. Metal cross bridging of equal or greater strength may be used in place of the wood cross bridging.

k. Cutting of Members. Cuts or bore holes in girders, beams or joists shall be limited to size and location that will not weaken the member for its intended use and in no case shall such cuts and bores be nearer the middle of the span than 1/3 from the ends.

Sec. 2507. Stud walls and partitions.

a. General. Wooden buildings shall have braced, balloon frames, or types equivalent in the opinion of the Superintendent, but balloon construction shall be allowed only for residence buildings not more than 2½ stories in height and for private garages, stables and in farm buildings.

b. Bearing Partitions. Stud bearing partitions and exterior wood frame walls shall be constructed with studding not less than 2 in. by 4 in., spaced not more than 16 in. on centers, except that studding in exterior walls of one story buildings 400 sq. ft. or less in area may be spaced not more than 24 in. on centers. Such exterior walls and bearing partitions may be constructed with larger members designed in accordance with provisions of this part.

c. Maximum Height of Partitions. The maximum allowable height for 2 in. x 4 in. stud framing shall be 14 ft. and 2 in. x 6 in. stud framing shall be 20 ft. unless the wall is supported laterally by adequate framing in a horizontal direction perpendicular to the direction of the stud wall. Additional horizontal and/or angle bracing shall be required when deemed necessary by the Superintendent.

d. Braced Frame. Braced frames shall have sills, corner posts, and girts not less than 4 x 6 in., plates not less than 2½ x 4 in. and braces not less than 2 x 4 in. Girts and posts shall be tenoned and pinned together. If posts are in more than one length they shall have a splice at least 12 in. long.

e. Balloon Frame. Balloon frames shall have sills and corner posts not less than 4 x 6 in., plates not less than 2.2 x 4 in. and ledger boards not less than 1 x 4 in., and notched into studs 1 in. deep. Outside wall stud shall run in one length from sill to plate, shall be doubled at sides of openings. Floor beams shall be spiked to wall studs or to blocking the full width of studs.

f. Plates. Plates or shoes shall be provided under all non-bearing partitions having dimensions not less than the studs. Studs in bearing partitions shall rest upon partition caps, beams or girts.

g. Pipes in Partitions. Stud partitions containing plumbing, heating or other pipes shall be so framed and the joists underneath so spaced as to give proper clearance for the piping. Where a partition containing such piping runs parallel to the floor joists, the joists underneath such partition shall be doubled and spaced to permit the passage of such pipes and shall be bridged with solid bridging. Such solid bridging supporting a bearing partition shall be spaced not more than 16 in. on centers.

h. Header Over Openings. Openings 4 ft. wide or less, in stud partitions and walls, shall be provided with double headers not less than 2 in. thick, placed on edge and such headers shall have not less than 2 in. solid bearings on the jack studs. All openings more than 4 ft. wide shall be trussed or provided with adequate lintels.

i. Studs More than One Story High. Where studs continue through from story to story, they shall be thoroughly and effectively fire stopped at points of passage through floors.

j. Corners. Angles at corners where stud walls or partitions meet shall be framed solid so no lath can extend from one room to another.

k. Wood Near Chimney. Wood lath, furring, or framing shall be placed not less than 1 in. from a chimney or fireplace, and no wood shall be supported by or nailed to chimney.

l. Wall Sheathing. Exterior walls shall be covered with ⅞ in. wood sheathing nailed twice at each bearing. Other types of wall sheathing or covering may be used when approved by the Superintendent.

m. Building Paper on Exterior Wall. Heavy building paper shall be applied on wood sheathing or other approved sheathing boards before the outside covering is applied. This paper shall be lapped 2 in. on horizontal joints and 6 in. on vertical joints.

Sec. 2508. Roof framing.

a. Valley Rafters, Roof Sheathing. Valley rafters shall be not less than 2 x 6 in. in size. Roof sheathing shall have a minimum thickness of ⅞ in.

b. *Flashing.* Flashings shall be placed around all openings in roofs and around extensions of mechanical appliances or equipment through the roof.

c. *Plates on Masonry Walls.* Wooden plates on masonry walls to receive sloping rafters shall be anchored to wall with bolts not less than ⅝ in. in diameter not less than 2 ft. 6 in. long, and not more than 6 ft. center to center.

d. *Collar Ties.* For all steeply sloping roofs there shall be a minimum of one 1 in. x 6 in. collar tie at every third rafter. Such tie shall be securely nailed and properly braced so that rafters will not have excessive deflection.

Sec. 2509. Deflection.

Joists supporting plastered ceiling shall be so proportioned that their deflection under full live load and dead load, shall not exceed one three-hundred and sixtieth of the span.

Sec. 2510. Framing details; trusses.

1. Wood trusses and truss framing shall have all joists accurately cut and fitted together so that each bearing is true and drawn tight to the full bearing. All such trusses shall be properly secured in place by lateral bracing.

2. Washers of sufficient size to distribute the loads properly shall be used in connection with rods or metal members. Before a truss is loaded, the tension rods shall be well tightened.

3. Timber trusses shall be securely anchored to the wall at points of bearing.

Sec. 2511. Fire stopping.

1. At all sills, dropped girts, ledger boards, plates, girders, bearing walls and bearing partition caps which support floor joists or rafters, spaces shall be filled to a height of 5 in. above the floor joists, and above plates supporting rafters to the under side of the roof boarding with brick or solid gypsum blocks laid in mortar, with cinder or stone concrete or with mineral wool.

2. Spaces between chimneys and wooden beams and between

wooden furrings on masonry walls for 5 in. above and below the floor joists with mortar or other approved incombustible material. Around pipes passing through wooden floors with metal or other approved incombustible stops.

3. Between the carriages of stairs twice in each flight and between rafters over dwarf partitions and between rafters at ends of ceiling beams, with closely fitted wood, tin or galvanized iron.

4. Fire stopping for buildings of Type 6 construction shall be as required for other types of construction except that closely fitted 2 in. plank may be substituted for the incombustible materials in all places except around chimneys and required stair enclosures.

5. In all places where fire-stopping is required the plastering shall run to the under floor.

6. All fire-stopping, electric wiring, rough plumbing and heating pipes shall be in place and approved before the lathing permit required under Section 207 is issued.

7. When sliding doors are pocketed in partitions, such pockets shall be completely fire stopped at end, sides, top and bottom.

Sec. 2512. Roof covering.

a. Wood Shingles. Wood shingles shall not be accepted for roof covering. All roof covering must be of the fire-resistive and fire-retardant type, and shall conform with Section 3705 of this Code.

b. Covering of Towers. The roof covering of all towers shall be of approved incombustible materials.

Sec. 2513. Miscellaneous wood frame structures.

Miscellaneous wood frame structures of an unusual character to which the provisions of this Part are not directly applicable, including structures for fair and exhibition purposes, towers for observation, amusement devices, greenhouses and lumber sheds, and temporary structures of any kind, shall be erected in accordance with plans approved by the Superintendent.

PART XXVI.

Structural Steel and Iron.

§ 2601. Design of structural steel and iron.
§ 2602. Loads.
§ 2603. Quality of steel and iron.
§ 2604. Allowable stresses in structural steel.
§ 2605. Allowable stresses in cast steel.
§ 2606. Allowable stresses in cast iron.
§ 2607. Steel tension members.
§ 2608. Steel columns.
§ 2609. Steel beams and girders.
§ 2610. Steel connections and details.
§ 2611. Rivet spacing.
§ 2612. Cast iron columns.
§ 2613. Filled pipe columns.
§ 2614. Stresses in steel due to wind.
§ 2615. Thickness of structural steel.
§ 2616. Expansion and contraction in steel frames.
§ 2617. Workmanship in steel construction.
§ 2618. Painting steel and iron.
§ 2619. Erection of steel.
§ 2620. Steel joists.
§ 2621. Column bases of steel and iron.

Sec. 2601. Design of structural steel and iron.

Structures of steel and iron shall be designed by methods admitting of rational analysis according to established principles of mechanics, supplemented by the assumptions herein specified, to support the loads and withstand the forces to which they are subject without exceeding the stresses allowed in this Part for the various members and the materials thereof.

Sec. 2602. Loads.

a. Dead Load. The dead load shall consist of the weight of the steelwork and all materials fastened thereto or supported thereby.

b. Live Load. The live loads shall conform to the provisions of Part 23.

c. Wind Load. The wind loads shall conform to the provisions of Section 2307.

d. Impact. For structures, carrying loads inducing impact or vibrational forces, the design stresses shall be increased by a percentage of live load stresses sufficient to suitably provide for such forces, see Section 2301.

Sec. 2603. Quality of steel and iron.

1. The materials of steel and iron construction shall conform to the specifications of the American Society for Testing Materials as follows:—

a. Structural Steel to Specifications for Steel for Bridges. A 7-39.
b. Rivet Steel to Specifications for Structural Rivet Steel. A 131-39.
c. Cast Steel to Specifications for Carbon Steel Castings. A 27-39.
d. Cast Iron to Specifications for Gray Iron Castings. A 48-36.

2. Special steels, alloys, high carbon steel and other metals may be used in connection with steel and iron construction with the approval of the Superintendent and subject to such conditions as he shall specify.

3. Structural steel which has previously been used in a building or other structure or which has been fabricated for such use, shall not be used in another building or structure except with the approval of the Superintendent and under such conditions as he may in each case specify. Holes in second-hand material shall not be filled in such manner as will tend to hide their existence, and such filling, if discovered, shall justify the Superintendent in refusing to allow the use of the material. All second-hand structural steel shall not be stressed beyond 16,000 lbs. per sq. in.

4. The Superintendent may require reasonable test from time to time of steel and iron to determine its quality and whether it conforms to the requirements of this Part.

Sec. 2604. Allowable stresses in structural steel.

1. The unit stress in member of rolled structural steel, except the stress due to wind, shall not exceed the following allowable stresses, in pounds per square inch:—

a. Tension, on net section	20,000
b. Compression in short members and where lateral deflection is prevented	20,000

c. Compression in columns and compressive members of trusses, axially loaded, on the gross section:

where $\left(\frac{L}{r}\right)$ is not more than 120 .... $17{,}000 - 0.485\,\frac{L^2}{r^2}$

and where $\left(\frac{L}{r}\right)$ is greater than 120 .. $\dfrac{18{,}000}{1 + \dfrac{L^2}{18{,}000\,r^2}}$

in which (L) is the unbraced length and (r) is the corresponding least radius of gyration of the column section.

d. Bending, maximum stress on the net section:

where lateral deflection is prevented or where $\left(\frac{L}{b}\right)$ is not more than 15 .. 20,000

and where $\left(\frac{L}{b}\right)$ is greater than 15 .. and does not exceed 40 $\dfrac{22{,}500}{1 + \dfrac{L^2}{1{,}800\,b^2}}$

in which (L) is the unbraced length of the compression flange, and (b) is the width of the compression flange

e. Shear, on the gross area of the webs of beams and girders 13,000

1. The bearing stress in members of rolled structural steel on pins, rivets and bolts with which they are connected, except the stress due to wind, shall not exceed the following allowable values in pounds per square inch:—

Bearing on Items	Double Shear	Single Shear
Pins	40,000	32,000
Rivets, power-driven	40,000	32,000
Turned bolts in reamed holes	40,000	32,000
Rivets, hand-driven	25,000	20,000
Unfinished bolts	25,000	20,000

2. The unit stress in pins, rivets and bolts with which rolled structural steel members are connected, except the stress due to wind, shall not exceed the following allowable stresses in pounds per square inch:—

a. Shear:

Pins	15,000
Rivets, power-driven	15,000
Turned bolts in reamed holes	15,000
Rivets hand-driven	10,000
Unfinished bolts	10,000

b. Tension:

Rivets	15,000
Bolts, on area at root of thread	18,000

c. Bending in pins	30,000

3. The bearing on expansion rollers in pounds per linear inch shall not exceed six hundred times the diameter in inches of the roller.

Sec. 2605. Allowable stresses in cast steel.

The unit compression and bearing in cast steel, except the stress due to wind, shall be the same as for structural steel. The other unit stresses shall be 75 per cent of those for structural steel.

Sec. 2606. Allowable stresses in cast iron.

The unit stress in cast iron, except that due to wind, shall not exceed the following allowable stresses in pounds per square inch.

a. Tension	3,000
b. Compression	10,000
c. Compression in columns axially loaded	$9{,}000-40\dfrac{L}{r}$

in which (L) is the unbraced length (r) is the corresponding least radius of gyration of the column section.

d. Bending:

In tension flange	3,000
In compression flange	10,000

Sec. 2607. Steel tension members.

1. Structural steel members and their connections, subject to reversal of tension and compression due to the action of live loads shall be designed to sustain either stress with half the other stress added, whichever requires the larger section. If the reversal of stress is due to the action of wind, the member shall be designed for the stress requiring the larger section and the connection shall be designed for the larger stress.

2. In calculating the net section of tension members, the area of rivet holes shall be deducted assuming the diameter of the holes to be at least one-eighth inch larger than the nominal size of the rivet.

3. Pin-connected tension members shall have an area of cross-section through the pin hole at least twenty-five per cent in excess of the net area required in the member, and a net area of cross-section back of the pin hole at least equal to the net area required on one side of the pin hole.

Sec. 2608. Steel columns.

1. The ratio $\frac{L}{r}$ shall not exceed one hundred and twenty for columns in buildings and main compression members in trusses and frames; nor two hundred for bracing and other secondary members.

2. Members subject to both axial and bending stresses shall be so proportioned that the quantity $\frac{f_a}{F_a} + \frac{f_b}{F_b}$ shall not exceed unity, in which

F_a = axial unit stress that would be permitted by this specification if axial stress only existed.

F_b = bending unit stress that would be permitted by this specification if bending stress only existed.

f_a = axial unit stress (actual) = axial stress divided by area of member

f_b = bending unit stress (actual) = bending moment divided by section modulus of member.

Sec. 2609. Steel beams and girders.

1. In rolled steel beams and girders, whether of solid section or built up, the ratio $\frac{(L)}{b}$ shall not exceed forty.

2. The compression flanges of beams, girders, lintels and similar members in bending shall in general be braced laterally, by the floor or roof construction or framing, or by struts or tie rods. Steel joists, floor slabs or other construction, to be considered effective bracing shall have positive connection to the beam or girder and friction shall not be relied upon. Standard diaphragm separators, joining two members in bending, or steel pipe separators with concrete filling, shall be considered effective lateral support to each of the members.

3. The span of beams and girders shall be taken as the distance from center to center of bearings. If a beam or girder is connected to the face of a flange or web of a column, the span shall be taken to such face.

4. In calculations for stress due to bending in built up beams and girders, and in rolled sections with punched flanges, the moment of inertia and section modulus of net sections shall be used.

5. Where beams or girders are composed of two or more I-beams or channels, they shall be so connected as properly to distribute the load to each member.

6. Beams, girders, and trusses of steel shall be so designed that the deflection under load shall not exceed one three-hundred and sixtieth of the span. The modulus of elasticity of rolled steel shall be taken as twenty-nine million pounds per square inch.

7. Beams and girders subject to the thrust of floor arches, purlins or inclined roofs, crane runway girders and other members subject to bending in more than one plane shall be so designed that the maximum unit stress due to combined loading shall not exceed the stress allowed in this chapter, except as provided in section 2605. Eccentric loads shall be provided for.

8. Members shall preferably be loaded so as not to be subjected to torsion (twisting normal to the span of the member). When this is impracticable provisions shall be made for the resultant stresses.

9. Beams which are wholly encased, as required for fireproofing

in the concrete of a reinforced concrete floor or roof may be designed for bending as composite beams.

10. Plate girder webs shall have a thickness not less than one hundred and seventieth of the clear distance between flanges, nor less than one-fourth inch.

11. Web splices shall have at least one plate on each side of the web riveted thereto in such manner that the shear is transmitted and bending, if the web is designed to resist bending.

12. Stiffeners shall be provided on both sides of the webs of plate girders over end bearings and where necessary at points of concentrated loads, designed to transmit the reactions and loads to the web. Bearing stiffeners shall not be crimped over flange angles, and shall be fitted to the flange angles where they bear. Where the ends of stiffener angles are chamfered to clear the fillets of flange angles, the outstanding legs only shall be computed in bearing and the average unit stress in bearing shall not exceed twenty-four thousand pounds per square inch. Where stiffener angles are raised from the web on fillets to clear the fillets of flange angles and the whole of the stiffener angle is fitted in bearing, the average unit stress shall not exceed twenty thousand pounds per square inch. Rivets shall be spaced not more than 8 times their nominal diameters.

13. Fitted stiffeners shall also be provided on the webs of rolled I-beams and channels where necessary to transmit to the web the end reactions or concentrated loads.

14. Intermediate stiffeners shall be required, if $\frac{h}{t}$ is equal to or greater than 70, at all points where $\frac{h}{t}$ exceeds $\frac{8000}{\sqrt{v}}$ in which

h = clear depth between flanges, in inches
t = thickness of the web in inches
v = greatest unit shear in panel under any condition of complete or partial loading, in pounds per square inch.

The clear distance between intermediate stiffeners, when stiffeners are required by the foregoing, shall not exceed 84 inches or that given by the formula

$$d = \frac{270{,}000\,t}{v} \times \sqrt[3]{\frac{v\,t}{h}}$$

where d = the clear distance between stiffeners, in inches.

Intermediate stiffeners may be crimped over the flange angles.

Sec. 2610. Steel connections and details.

1. Rivets driven in the field or shop by approved pneumatic hammers shall be considered power-driven rivets. Turned bolts shall have a clearance in reamed holes not more than one-fiftieth inch; holes shall be reamed after assembly of the members connected. The finished shank of turned bolts shall be long enough to provide full bearing, with washers under the nuts to permit tight gripping of members when turned up, and nuts shall be locked.

2. Riveted joints shall be designed to transmit the entire stress through the rivets, except as otherwise provided in paragraph 3.

3. Joints in compression members shall be fully spliced, except that where reversal of stress is not possible and the joint is supported laterally, the ends of the members may be milled to plane parallel surfaces and abutted, with sufficient splicing to hold the connected members accurately and firmly in place and in bearing.

4. Riveted connection transmitting calculated stress, except in lacing and sag bars, shall have not less than two rivets.

5. Members in tension or compression meeting at a joint shall have their lines of center of gravity pass through a point, if practicable; and if not, provision shall be made for the eccentricity.

6. A group of rivets transmitting stress to a member shall have its center of gravity in the line of stress if practicable; and if not the group shall be designed for the resulting eccentricity.

7. When a beam or girder is connected by a connection more rigid than a standard web connection, to a supporting member in such a way that it acts as continuous or fixed at the end, proper provision shall be made for the bending and torsional moments at the connection, in beams and columns.

8. When stress is transmitted from one member to another by rivets through a filler, the number of rivets shall be increased thirty per cent over the number required for connecting members in contact. The additional rivets so provided may be used to produce a tight filler.

9. In designing riveted or bolted connections, the nominal diameter of the rivet or bolt shall be used.

10. Rivets transmitting calculated stress, when the grip exceeds five diameters, shall be increased in number, one per cent for each additional one-sixteenth inch in grip. Special care shall be taken in heating and driving such rivets.

11. The required strength of riveted connection shall be developed by the shearing and bearing values of the rivets, but rivets in shelf

angles or bracket supports, and in connections in so far as they also afford rigidity to the structure, may transmit stress by tension.

12. The provisions of this section for riveted connection shall also apply, where pertinent, to bolted connections.

13. Rivets or turned bolts shall be used for either shop or field work in the fabrication and erection of primary members, members carrying loads which produce impact or vibration and in connections subject to reversal of stress, except as otherwise provided in paragraphs 14 and 15.

14. Unfinished bolts may be used for primary and secondary field connections in buildings other than Type 1 and Type 2, in buildings of Type 1 and Type 2 less than ten thousand square feet in total floor area, and in the connections to cast iron or filled pipe columns, connections of secondary members in all structures, such as purlins, girts, door and window framing, alignment bracing, and secondary beams in floors and roofs.

15. Fusion welding may be substituted for, or used in combination with riveting or bolting to connect or assemble component parts of steel beams, girders, lintels, trusses, columns and other structural steel used in building construction if done under rigid inspection in accordance with approved specification, "Code for Fusion Welding and Gas Cutting in Building Construction" (Code 1, Part A Structural Steel, Edition of 1934) of the American Welding Society.

Sec. 2611. Rivet spacing.

a. Minimum Pitch. The preferable minimum distance between centers of rivet holes shall be not less than 4½ inches for 1¼ inch rivets, 4 inches for 1⅛ inch rivets, 3½ inches for 1 inch rivets, 3 inches for ⅞ inch rivets, 2½ inches for ¾ inch rivets, 2 inches for ⅝ inch rivets and 1¾ inches for ½ inch rivets, but in no case shall it be less than three times the diameter of the rivet.

b. Maximum Pitch Compression Members. The maximum pitch in the line of stress of compression members composed of plates and shapes shall not exceed 16 times the thickness of the thinnest outside plate or shape, nor 20 times the thinnest enclosed plate or shape with a maximum of 12 inches, and at right angles to the direction of stress the distance between lines of rivets shall not exceed 30 times the thickness of the thinnest plate or shape. For angles in built sections with two gage lines, with rivets staggered, the maximum pitch in the line of stress in each gage line shall not exceed

24 times the thickness of the thinnest plate with a maximum of 18 inches.

c. *End Pitch Compression Members.* The pitch of rivets at the ends of built compression members shall not exceed four diameters of the rivets for a length equal to 1½ times the maximum width of the member.

d. *Two-Angle Member.* In tension members composed of two angles, a pitch of 3′-6″ will be allowed, and in compression members, 2′-0″, but the ratio 1-r for each angle between rivets shall be not more than ¾ of that for the whole member.

c. *Minimum Edge Distance.* The minimum distance from the center of any punched rivet hole to any edge shall be that given in the following table.

TABLE 2611.

Rivet Diameter Inches	Minimum Edge Distance (Inches) for Punched Holes		
	In Sheared Edge	In Rolled Edge of Plates and Sections with Parallel Flanges	In Rolled Edge of Sections with Sloping Flanges
½	1	⅞	¾*
⅝	1⅛	1	⅞*
¾	1¼	1⅛	1 *
⅞	1½	1¼	1⅛*
1	1¾	1½	1¼*
1⅛	2	1¾	1½*
1¼	2¼	2	1¾*

*May be decreased ⅛ inch when holes are near end of beam.

f. *Minimum Edge Distance in Line of Stress.* The distance from the center of any rivet under computed stress, and that end or other boundary of the connected member toward which the pressure of the rivet is directed, shall be not less than the shearing area of the rivet shank (single or double shear respectively) divided by the plate thickness.

This end distance may however be decreased in such proportion as the stress per rivet is less than that permitted under Section 2604; and the requirement may be disregarded in case the rivet in question is one of three or more in a line parallel to the direction of stress.

g. *Maximum Edge Distance.* The maximum distance from the center of any rivet to the near edge shall be 12 times the thickness of the plate, but shall not exceed 6 inches.

Sec. 2612. Cast iron columns.

1. Cast iron columns shall not be used in the primary structural frames of buildings whose height exceeds sixty feet or twice the width at the ground level. Cast iron shall not be used for columns required to have four-hour fire-resistive protection.

2. The ends of cast iron columns shall be machined to a smooth plane surface perpendicular to the axis to provide full bearing for the entire cross-section of the column.

3. Hollow cast iron columns, except when open at both ends and without flanges, shall have two three-eighths inch holes drilled in the shell to exhibit the thickness thereof. If the columns are cast on the side, both holes shall be in the top side as cast, one hole about twelve inches toward each end from mid-length of the column. If the columns are cast on end, both holes shall be at mid-height at ninety degrees from one another about the axis of the column. Additional holes shall be drilled when required by the Superintendent. If the core of a cast iron column is found to have shifted more than one quarter the thickness of the shell, the strength shall be computed assuming the thickness all around to be that of the thinnest part.

4. Cast iron columns shall not be smaller than six inches in outside diameter or side, and the thickness of metal shall not be less than three-fourths inch nor less than one-twelfth the outside diameter or widest side.

5. Cast iron columns supporting a floor shall not be longer than seventy times the least radius of gyration or twenty-four times the outside diameter or least side. Cast iron columns supporting roof loads only shall not be longer than ninety-six times the least radius of gyration or thirty times the outside diameter or least side.

6. Cast iron columns shall not be used where the loading is so eccentric as to cause tension, nor shall they be used in garages or other structures where they may be subject to impact from vehicles.

Sec. 2613. Filled pipe columns.

1. Steel or wrought iron pipes or tubing filled with concrete may be used as columns. Their capacity under axial load shall be assumed as not more than that of the pipe or tube computed as provided in this chapter plus the capacity of the concrete. The average

stress on the concrete shall not exceed one-fourth the twenty-eight day strength of the concrete according to its proportions determined as specified in Part XXVII.

2. The pipe of tubing shall be new material of steel or wrought iron. If the material of the shell has a lower yield point in tension or compression than structural steel the allowable stress shall be reduced proportionally. Shells shall be cut square to length and shall be straight before filling. Shells larger than four inches in outside diameter shall not be thinner than standard steel pipe.

3. Concrete filling for pipe columns shall be proportioned for a strength of not less than three thousand pounds per square inch as specified in Part XXVII.

4. Longitudinal steel reinforcement in filled pipe columns when straight, symmetrically placed and faced for bearing at the ends shall be assumed to be integral with the shell, and the radius of gyration of the combined metal cross-section shall be used with the allowable unit stress of the weaker metal in computing the capacity of the columns. Suitable arrangement shall be made for bearing on the ends of reinforcement.

5. Cap plates of filled pipe columns shall be of steel and shall be firmly attached to the tops of the columns by an approved method. Brackets may be used under cap plates where desired to avoid excess of local stress.

6. Material surrounding a filled pipe column for fire protection shall not be considered either load-bearing or as increasing the radius of gyration.

7. When required by the Superintendent, an applicant for permit for construction with concrete filled pipe columns shall employ an inspector satisfactory to the Superintendent who shall inspect the filling of the column and attach a permanent label to columns inspected and approved.

Sec. 2614. Stresses in steel due to wind.

Structural steel members subject to stress due to wind shall be so designed that the maximum unit stress from all loads and forces combined shall not exceed by more than one-third the allowable stress specified in this Part, and the unit stress due to loads and forces other than wind shall not exceed the specified allowable stresses.

Sec. 2615. Thickness of structural steel.

The thickness of metal in structural members of steel shall be not less than one-quarter inch where protected from moisture and from the weather, and five-sixteenths inch where exposed to moisture or the weather, except the edges of flanges and the webs of rolled beams, channels and steel studs, steel joists as defined in section 2620, stairs, fire escapes, signs, skylights, windows, non-bearing walls and partitions, suspended ceilings, cornice brackets, ventilating hoods and other light iron work and structural steel for buildings of type 5 one story high. Gusset plates for trusses with end reactions greater than 35,000 pounds shall be not less than 3/8 inch thick.

Sec. 2616. Expansion and contraction in steel frames.

Proper provision shall be made for expansion and contraction.

Sec. 2617. Workmanship in steel construction.

1. Structural steel members shall be straight and true and any piece damaged to such an extent as to impair its strength shall not be used in the construction of a building.

2. Structural steel members shall not be cut, notched, or pierced for clearance of pipes, conduits, wire, ducts or for other reasons, in such a way as to impair their strength unless provision therefor has been made in the design.

3. Drifting to enlarge unfair holes shall not be permitted. Rivet holes shall not be burned.

4. The several pieces forming built-up sections shall be straight and shall fit closely together; and finished members shall be free from twists, bends or open joists.

5. Rolled sections shall not be heated in any manner which will impair their strength or quality, nor cut with the torch while under stress. A torch shall not be used in the field to cut structural steel except with the approval of the Superintendent, and in the presence of an inspector appointed by him.

6. Steel castings shall be properly annealed.

7. Except under such conditions as the Superintendent may specify, rivets shall be driven at bright red heat, and wherever practicable, by power riveters. Rivet heads shall be of hemispherical shape, uniform in size throughout the work for the same size rivet, full,

neatly finished and concentric with the holes. Rivets after driving, shall be tight, completely filling the holes, and with heads in full contact with the gripped surfaces.

Sec. 2618. Painting steel and iron.

1. Structural Steel (except the parts which are to be welded, surfaces in contact or entirely encased in concrete) shall be thoroughly cleaned before erection and painted one coat of approved paint well worked into joints and open spaces including surfaces which have been welded.

2. After erection, steel work (except steel joists and other secondary members formed from sheet steel, and except members encased in concrete) shall be painted an additional approved coat of another color.

3. Required shop painting of shop-welded work shall be applied after the welding is completed. Required shop painting of work to be field welded shall consist of a coat of linseed oil. Required field painting of field-welded work shall be applied after welding is finished and shall consist of a coat of linseed oil or other approved protective covering.

4. Steel which is part of the primary frame of a building, embedded in exterior masonry walls, may be protected from corrosion by a trowel coating of mastic asphalt or pitch not less than one-eighth inch thick, or its approved equivalent, in lieu of the painting specified in this section.

5. Welded connections and cast iron columns shall not be painted until after inspection and approval of the Superintendent.

Sec. 2619. Erection of steel.

1. The steel frames of buildings or other structures shall be erected true and plumb, and temporary bracing shall be provided wherever necessary to support the loads to which the structure may be subjected, including wind erection equipment and its operation. Such bracing shall be left in place as long as required for safety.

2. As erection progresses, the work shall be securely bolted so as to resist all stresses to which it may be subjected.

3. No field riveting or welding shall be done in any portion of a structure until that portion has been properly plumbed and aligned.

4. In the setting or erecting of steel work the individual pieces shall be considered plumb or level when the error does not exceed

one in five hundred. Exterior columns and columns adjacent to elevator shafts shall not be out of plumb in excess of one in one thousand, in the total height of the columns.

Sec. 2620. Steel joists.

1. Steel joists, for the purposes of this Part, shall mean light weight rolled steel sections, welded truss assemblies or expanded rolled sections. They shall include—

   a. Junior beams, so-called.
   b. Beams of I-section or channels, fabricated by bending, pressing or expanding sheet steel.
   c. Steel joists, so-called, consisting of trussed members of which the chords are made of bars or of structural shapes thinner than one quarter inch, or the webs are made of bars, assembled by welding or otherwise; or fabricated by shearing and expanding the web of rolled I-beam; or any similar trussed steel beam.

2. Steel joists shall not be more than twenty inches deep.

3. Steel joists shall not be used in floors of garages, dance halls, gymnasiums, armories, or floors used for any other purpose when subject to vibration, impact, or heavy, moving load concentrations.

4. The provisions of this Part for design and materials of structural steel shall apply to steel joists.

5. Every steel joist, when erected and bridged, shall be capable of supporting safely a concentrated load of at least eight hundred pounds at any panel point. Welded joints of trussed joists, when tested shall be capable of resisting at least three times the maximum design stress.

6. The span of steel joists having a top cord of steel with a wood nailing strip attached, shall not exceed one hundred and sixty times the width of the top chord or top flange nor twenty-four times the depth of the joist, except that the span of joists with solid webs may be longer if the deflection under live load will not exceed one three-hundred-sixtieth of the span. The span of steel joists having an all steel top chord without nailing strip, shall not exceed 550 times the radius of gyration of the top chord in a plane perpendicular to the web of the joist.

7. Bridging shall be provided for steel joists to afford lateral support during erection and to distribute concentrations of live load

among adjacent joists. Bridging shall be of approved rigid type capable of transmitting at least five hundred pounds to each adjacent joist and shall securely support the top chord of flange against lateral displacement. Such bridging shall be provided at intervals not more than eight feet nor more than forty times the width of the top flange or chord. Unless steel joists are supported at the ends by web connection, built into masonry walls or otherwise supported laterally, they shall have bridging at the ends.

8. Steel joists parallel to masonry walls or to steel or concrete beams shall have both top and bottom chords or flanges anchored thereto in the line of bridging. Such anchors shall consist of flat steel not less than one inch by one-eighth inch effectively arranged, or other equivalent approved anchorage.

9. Steel joists shall have at least four inches bearing on masonry walls and shall be anchored thereto by approved anchor. Steel joist supported on the top of steel beams shall have at least three inches bearing and shall extend at least one inch beyond the center line of the web. Steel joists depended upon for lateral support to a beam shall have positive connection thereto other than by friction. Steel joists shall be secured against lateral displacement at the ends.

10. Steel joists shall not be used in the first floor of a building where there is not a basement or cellar below, unless it has clearance above the ground of at least twenty-four inches, and the space below is ventilated either to a heated basement or to the outside air. Ventilation of such space to a heated basement shall consist of at least two remote openings in the basement wall having a total area of at least two square feet for each twenty-five linear feet of wall. Ventilation of such space to outside air shall consist of one or more openings in each exterior wall thereof, well distributed, except that openings need not be provided in the front wall when the space is ventilated in the rear and both side walls. The aggregate area of openings shall be not less than two square feet for each twenty-five linear feet of wall. Openings in exterior walls shall be protected by non-corrodible wire mesh with openings not greater than one-half inch.

11. Except as otherwise provided in this section, steel joist construction shall conform with the Standard Specifications for Steel Joists of the Steel Joist Institute, as adopted April 23, 1941.

Sec. 2621. Column bases of steel and iron.

1. Steel or cast iron bases under steel, cast iron or filled pipe col-

umns shall have bearing faces that are plane and smooth. They shall be designed on the assumption that the column bears uniformly upon the supporting foundation, except when the column is anchored to the foundation to resist calculated bending.

2. Cast iron bases shall be planed on top and bases which rest on structural steel members shall be planed on the bottom. The thickness of cast iron shall be not less than one inch. The outer edge of the ribs of ribbed bases shall be inclined not less steeply than forty-five degrees. A side of the bed plate of ribbed bases exceeding two feet in length shall have a reinforcing flange at least one inch high for each foot of length of side.

PART XXVII.

Reinforced Concrete.

§ 2701. General.
§ 2702. Definitions and notations.
§ 2703. Tests, supervision and materials.
§ 2704. Concrete quality and working stresses.
§ 2705. Mixing and placing concrete.
§ 2706. Forms and details of construction.
§ 2707. Design, general information.
§ 2708. Flexural computations.
§ 2709. Cinder concrete floor and roof slab.
§ 2710. Shear and diagonal tension.
§ 2711. Bond and anchorage.
§ 2712. Flat slabs, with square or rectangular panels.
§ 2713. Reinforced concrete columns and walls.
§ 2714. Concrete footings.

Sec. 2701. General.

a. Scope. These regulations cover the use of reinforced concrete and plain concrete in buildings and structures to be erected under the provisions of this Code.

b. Notify Superintendent. When concrete is to be poured, the person who has obtained a permit for such work, shall notify the Superintendent, at least 24 hours prior to the time when the concrete is to be poured.

c. Special Systems of Reinforced Concrete. The sponsors of any system of reinforced concrete which has been in successful use, and the design of which is either in conflict with these regulations or not covered by them, shall have the right to present data on which their design is based, to the Superintendent, in accordance with Section 204, h, of this Code.

Sec. 2702. Definitions and notations.

DEFINITIONS.

The following terms are defined for use in this Part:

Aggregate. Inert material which is mixed with Portland cement and water to produce concrete.

Column. An upright compression member the length of which exceeds three times its least lateral dimension.

Column Capital. An enlargement of the upper end of a reinforced concrete column designed and built to act as a unit with the column and flat slab.

Column Strip. A portion of a flat slab panel one-half panel in width occupying the two quarter-panel areas outside of the middle strip, and extending through the panel in the direction in which bending moments are being considered.

Combination Column. A column in which a structural steel section, designed to carry the principal part of the load, is wrapped with wire and encased in concrete of such quality that some additional load may be allowed.

Composite Column. A column in which a steel or cast-iron section is completely encased in concrete containing reinforcement of spiral reinforcement and longitudinal bars.

Concrete. A mixture of Portland cement, fine aggregate, coarse aggregate and water.

Deformed Bar. Reinforcing bars with closely spaced shoulders, lugs or projections formed integrally with the bar during rolling so as to firmly engage the surrounding concrete. Wire mesh with welded intersections not farther apart than twelve inches in the direction of the principal reinforcement and with cross wires not smaller than No. 10 may be rated as a deformed bar.

Diagonal Band. A group of bars covering a width approximately 0.4 the average span, symmetrical with respect to the diagonal running from corner to corner of the panel of a flat slab.

Direct Band. A group of bars, covering a width approximately $0.4\ l_1$, symmetrical with respect to the center lines of the supporting columns of a flat slab.

Dropped Panel. The structural portion of a flat slab which is thickened throughout an area surrounding the column capital.

Effective Area of Concrete. The area of a section which lies between the centroid of the tensile reinforcement and the compression face of a slab or beam.

Effective Area of Reinforcement. The area obtained by multiplying the right cross-sectional area of the metal reinforcement by the cosine of the angle between its direction and that for which the effectiveness of the reinforcement is to be determined.

Flat Slab. A concrete slab reinforced in two or more directions, generally without beams or girders to transfer the loads to supporting columns.

Middle Strip. A portion of a flat slab panel one-half panel in width, symmetrical with respect to the panel center line and extending through the panel in the direction in which bending moments are being considered.

Paneled Ceiling. The ceiling of a flat slab in which approximately that portion of the area enclosed within the intersection of the two middle strips is reduced in thickness.

Panel Length. The distance along a panel side from center to center of columns of a flat slab.

Pedestal. An upright compression member whose height does not exceed three times its least lateral dimension.

Plain Concrete. Concrete without metal reinforcement, or reinforced only for shrinkage or temperature changes.

Ratio of Reinforcement. The ratio of the effective area of the reinforcement cut by a section of a beam or slab to the effective area of the concrete at that section.

Reinforced Concrete. Concrete in which metal other than that provided for shrinkage or temperature changes is embedded in such a manner that the two materials act together in resisting forces.

Surface Water. The water carried by the aggregate except that held by absorption within the aggregate particles themselves.

b. Notations. The symbols and notations used in these regulations are defined as follows:

a = Width of face of column or pedestal.

α = Angle between inclined web bars and axis of beam.

A = Total area of top of pedestal, pier, or footing at the column base; see also A in Section 2712, a.

A′ = Loaded area of pedestal, pier, or footing at the column base.

A_{av} = Average of the two values of A for the two columns at the ends of a column strip, in the direction of the spans considered.

A_c = Area of core of a spirally-reinforced column measured to the outside diameter of the spiral; net area of concrete section of a composite column.

A_g = The overall or gross area of spirally-reinforced or tied columns; the total area of the concrete encasement of combination columns.

A_r = Area of the steel or cast-iron core of a composite column; the area of the steel core in a combination column.

A_s = Effective cross-sectional area of reinforcement in tension in beams or in compression in columns; the effective cross-sectional area of reinforcement which crosses any of the principal design sections of a flat slab.

A_v = Total area of web reinforcement in tension within a distance of s (measured perpendicular to the direction of the web reinforcement bar), or the total area of all bars bent up in any one plane.

b = Width of rectangular beam or width of flange of T-beam.

b' = Thickness of web in beams of I, L, or T sections.

b_1 = Dimension of the dropped panel of a flat slab in the direction parallel to l_1.

c = Diameter, in feet, of column capital of a flat slab at the underside of the slab, or dropped panel. No portion of the column capital shall be considered for structural purposes which lies outside of the largest 90° cone that can be included within the outlines of the column capital; distance from gravity axis to extreme fiber in compression (in a column).

C = Ratio of allowable concrete stress, f_a, in axially loaded column to allowable fiber stress for concrete in flexure, also c for cinder concrete (see Section 2709, 1, e).

C_o = For 2 way slabs (see Section 2708, i, 2).

c_1 = For 2 way slabs (see Section 2708, i, 3).

d = Depth from compression face of beam or slab to center of longitudinal tensile reinforcement; the least lateral dimension of a concrete column; the diameter of a round bar or side of a square bar.

$D = \frac{t}{2R}$ = a factor, usually varying from 3 to 9. (The term

R as used here is the radius of gyration of the column section.)

D = Deflection of a floor member under test load.

e = Eccentricity of the resultant load on a column, measured from the gravity axis.

E_c = Modulus of elasticity of concrete in compression.

E_s = Modulus of elasticity of steel in tension or compression (30,000,000 lbs. per sq. in.)

f_a = Allowable unit stress in the concrete of an axially loaded reinforced concrete column.

f_c = Computed concrete fiber stress in an eccentrically loaded column.

f_c = Compressive unit stress in extreme fiber of concrete in flexure or axial compression in concrete in columns.

f'_c = Ultimate compressive strength of concrete usually at age of 28 days. (Section 2704, a.)

f_p = Maximum allowable concrete fiber stress in an eccentrically loaded column.

f_r = Permissible unit stress in the metal core of a composite column.

f'_r = Permissible unit stress on unencased steel columns and pipe columns.

f_s = Tensile unit stress in longitudinal reinforcement; nominal working stress in vertical column reinforcement.

f'_s = Useful limit stress of spiral reinforcement.

f_v = Tensile unit stress in web reinforcement.

$$F = \frac{\text{Yield point of pipe}}{45{,}000}$$ (See Section 2713, f, 2.)

h = Unsupported length of column.

I = Moment of inertia of a section about the neutral axis for bending.

j = Ratio of distance between centroid of compression and centroid of tension to the depth (d).

K = Least radius of gyration of a metal pipe section (in pipe columns); the stiffness factor, that is, the moment of inertia divided by the span.

l = Span length of beam or slab; span length of flat slab (usually expressed in feet) center to center of columns in the direction in which moments are considered.

l_1 = Span length of flat slab panel center to center of columns, perpendicular to the rectangular direction in which moments are considered.

l' = Clear span for positive moment and the average of the two adjacent clear spans for negative moment.

L = Span of member under load test. Span of strip for 2 way slab.

L_1 = For 2 way slabs (see Section 2708, i, 2).

M = Bending moment or moment of resistance in general.

M_0 = Sum of positive and negative bending moments at the principal design sections of a panel of a flat slab.

n = Ratio of modulus of elasticity of steel to that of concrete = E_s/E_c.

$$n = \frac{30{,}000}{f'_c}$$

p = Ratio of effective area of tensile reinforcement to effective area of concrete in beams.

Σ_0 = Sum of perimeters of bars in one set.

p_g = Ratio of the effective cross-sectional area of vertical reinforcement to the gross area A_g.

p' = Ratio of volume of spiral reinforcement to the volume of the concrete core (out to out of spirals) of a spirally reinforced concrete column.

P = Total allowable axial load on a column whose length does not exceed 10 times its least cross-sectional dimension.

r = For 2 way slabs (see Section 2708, i, 2).

r_a = Permissible unit working stress in concrete over the loaded area of a pedestal, pier, or footing.

R = Least radius of gyration of a section; ratio of gross area to core area of a spirally-reinforced concrete column, A_g/A_c.

s = Spacing of stirrups or of bent bars in a direction parallel to that of the main reinforcement.

t = Thickness of the flange or T-beams; the total thickness or depth of a member under load test.

t_1 = Thickness of flat slab without dropped panels; or the thickness of flat slabs, including dropped panels where such are used.

t_2 = Thickness of flat slab with dropped panels at points outside the dropped panel.

u = Bond stress per unit of surface area of bar.

v = Shearing unit stress.

v_c = Unit shearing stress permitted on the concrete of the web.

V = Total shear.
V′ = Excess of the total shear over that permitted on the concrete.
w = Uniformly distributed load per unit of length of beam or slab.
w′ = Uniformly distributed dead and live load per unit of area of floor or roof.
W = Total dead and live load uniformly distributed over a single panel area.
x = Coefficient of span (L) which gives the distance from the center of column to the critical section for negative bending in design according to Section 2712, d, 1.
p′ = Total allowable axial load on a long column.

Sec. 2703. Tests, supervision and materials.

a. Tests. 1. The Superintendent, or his authorized representative shall have the right to order the test of any material entering into concrete or reinforced concrete when there is reasonable doubt as to its suitability for the purpose; to order reasonable tests of the concrete from time to time to determine whether the materials and methods in use are such as to produce concrete of the necessary quality; and to order the test under load of any portion of a completed structure, when the conditions have been such as to leave reasonable doubt as to the adequacy of the structure to serve the purpose for which it is intended.

2. Tests of materials and of concrete shall be made in accordance with the requirements of the American Society for Testing Materials as noted elsewhere in this Section. The complete records of such tests shall be available for inspection by the Superintendent at all times during the progress of the work, and shall be preserved by the engineer or architect for two years after the completion of the structure.

b. Load Tests. 1. When a load test is required, the member or portion of the structure under consideration shall be subject to a superimposed load equal to one and one-half times the live load plus one-half of the dead load. This load shall be left in position for a period of twenty-four hours before removal. If, during the test, or upon removal of the load, the member or portion of the structure shows evident failure, such changes or modifications as are necessary to make the structure adequate for the rated capacity shall be made; or, where lawful, a lower rating shall be established. The structure shall be considered to have passed the test if the maximum deflection at the end of the twenty-four hour period does not exceed the value of D as given by the following:

$$D = \frac{.001L^2}{12\,t} \text{ in which}$$

L is the span, t is the total depth of the slab or beam and D is the maximum deflection—all expressed in the same units.

2. If the deflection exceeds the value of D the construction shall be considered to have passed the test if within twenty-four hours after the removal of the load the slabs or beams show a recovery of at least seventy-five percent of the observed deflection.

c. Supervision. 1. The Superintendent may require an applicant for a permit for the structural use of concrete to have a competent inspector satisfactory to the Superintendent, at all times on the work while concrete is being mixed or deposited, and such inspector shall make daily reports to the Superintendent on the progress of the work.

2. Also all concrete work shall be supervised by the architect or engineer responsible for its design. A record shall be kept of such supervision, which record shall cover the quality and quantity of concrete materials, the mixing and placing of the concrete, and the placing of the reinforcing steel. A complete record shall also be kept of the progress of the work and of the temperatures, when these fall below 40 degrees F., and of the protection given to the concrete while curing. This record shall be available for inspection by the Superintendent at all times during the progress of the work and a copy shall be filed with the Superintendent of Buildings.

d. Portland Cement. Portland cement shall conform to the "Standard Specifications for Portland Cement" (A.S.T.M. Serial Designation: C9-38) or the "Standard Specifications for High-Early Strength Portland Cement" (A.S.T.M. Serial Designation: C74-39).

e. Concrete Aggregate. 1. Concrete aggregates shall conform to the "Standard Specifications for Concrete Aggregates" (A.S.T.M. Serial Designation: C33-39). Except that aggregates that have been shown by test or actual service to produce concrete of the required strength, durability, water-tightness and wearing qualities may be used under Section 2704, Method 2, where authorized by the Superintendent.

2. The maximum size of the aggregate shall be not larger than

one-fifth of the narrowest dimension between forms of the member for which the concrete is to be used nor larger than two-thirds of the minimum clear spacing between reinforcing bars.

f. Water. Water used in mixing concrete shall be clean, and free from deleterious amounts of acids, alkalis, oil, or organic materials. In general, water suitable for drinking is acceptable for use in concrete.

g. Metal Reinforcement. 1. Metal reinforcement shall conform to the requirements of the "Standard Specifications for Billet-Steel Concrete Reinforcement Bars" (A.S.T.M. Serial Designation: A15-39), or for "Rail-Steel Concrete Reinforcement Bars" (A.S.T.M. Serial Designation: A16-35).

2. Welded wire fabric or cold-drawn wire for concrete reinforcement shall conform to the requirements of the "Standard Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement" (A.S.T.M. Serial Designation: A82-34), or A185-37 Wire Fabric for Concrete Reinforcement, welded steel.

3. Structural steel shall conform to the requirements of the "Standard Specifications for Structural Steel for Bridges and Buildings" (A.S.T.M. Serial Designation: A7-39).

4. Cast-iron sections for composite columns shall conform to the "Tentative Specifications for Cast-Iron Pit-Cast Pipe for Water and Other Liquids" (A.S.T.M. Serial Designation: A44-39T).

h. Storage of Materials. Cement and aggregates shall be stored at the work in such a manner as to prevent deterioration or intrusion of foreign matter. Any material which has deteriorated or which has been damaged shall not be used for concrete.

Sec. 2704. Concrete quality and working stresses.

a. Concrete Quality. 1. For the design of reinforced concrete structures, the value of f′c used for determining the working stresses as stipulated in Section 2704, e shall be based on the specified minimum ultimate 28-day compressive strength of the concrete, or on the specified minimum ultimate compressive strength at the earlier age at which the concrete may be expected to receive its full load. All plans, submitted for approval or used on the job shall clearly show the assumed strength of concrete at a designated age for which all parts of the structure were designed.

2. All concrete exposed to the weather shall have a minimum ultimate 28-day compressive strength of not less than 2500 lbs. per sq. in.

b. Determination of Strength-Quality of Materials. The determination of the proportions of cement, aggregate and water to attain the required strengths shall be made by one of the following methods:

Method 1. Concrete Made from Average Materials. When no preliminary tests of the materials to be used are made, the water-content per sack of cement shall not exceed the values in Table 2704A. Method 2 shall be employed when artificial aggregates or admixtures are used.

TABLE 2704A.

ASSUMED STRENGTH OF CONCRETE MIXTURES.

Minimum proportions Volume of Portland cement to sum of separate volumes of fine and coarse aggregates measured dry and loose	Water content U. S. gallons per 94 lb. sack of cement*	Assumed compressive strength at 28 days (pounds per sq. in.)
1:7½	8.00	1500
1:6	7.50	2000
1:5¼	6.75	2500
1:4½	6.00	3000
1:3½	5.00	3750

*Including the surface water content of the aggregate. Unless this content is determined by tests, it shall be assumed to be one-half gallon per cubic foot of fine aggregate.

Method 2. Controlled Concrete. Proportions of the materials and water-content, other than those shown in Table 2704A, may be used provided that the strength-quality of the materials proposed for use in the structure shall be established by tests which shall be made in advance of the beginning of operations, using the consistencies suitable for the work and in accordance with the "Standard Method of Making Compression Tests of Concrete" (A.S.T.M. Serial Designation: C39-39). A curve representing the relation between the water-content and the average 28-day compressive strength or earlier strength at which the concrete is to receive its full working load, shall be established for a range of values including all the compressive strengths called for on the plans. The curve shall be established by at least four points, each point representing average values from at least four test specimens. The water-content used in the concrete for the structure as determined from the curve, shall correspond to a strength which is twenty per cent greater than that called for on plans, for concrete of a compressive strength less than 2500 lbs. per sq. in., and fifteen per cent greater for concrete of a compressive strength of 2500 lbs. per sq. in. or more. No substitutions shall be made in the materials used on the work without additional tests in accordance herewith to show that the quality of the concrete is satisfactory.

c. Tests on Concrete. 1. The Superintendent shall at his discretion require a reasonable number of compression tests to be made during the progress of work. Such tests shall be made in accordance with the "Standard Method of Making and Storing Compression Test Specimens of Concrete in the Field" (A.S.T.M. Serial Designation: C31-39).

2. Laboratory control tests and field control tests, or laboratory control tests only may be required. Not less than the number of specimens shown in the following table shall be made for each type of test, and not less than three specimens for each type of test for each strength of concrete for any one day's operation.

Total Cubic Yards of Concrete Placed	Minimum Number of Test Specimens
0— 100	One for each 50 cu. yd.
100—1000	One for each 125 cu. yd.
1000—2000	One for each 175 cu. yd.
2000—and over	One for each 250 cu. yd.

3. The standard age of test shall be 28 days, but 3-day or 7-day tests may be used provided that the relation between the 3-day or 7-day strengths and 28-day strengths of the concrete is established by test for materials and proportions used.

4. In all cases where the average strength of the Laboratory control cylinders shown by these tests for any portion of the structure falls below the minimum ultimate compressive strengths called for on the plans, the Superintendent shall have the right to order a change in the mix or in the water-content for the remaining portion of the structure. In cases where the average strength of the cylinders cured on the job falls below the required strength, the Superintendent shall have the right to require conditions of temperature and moisture necessary to secure the required strength and may require load tests to be made on the portions of the building so affected as specified in Section 2703, b.

d. Concrete Proportions and Consistency. 1. The proportions of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate or excess free water to collect on the surface. The combined aggregates shall be of such composition of sizes that when separated on the No. 4 standard sieve, the weight passing the sieve (fine aggregate) shall not be less than 30 per cent nor greater than 50 per cent of the total unless otherwise required by the Superintendent, except that these proportions do not necessarily apply to light-weight aggregates.

2. The methods of measuring concrete materials shall be such that the proportions can be accurately controlled and easily checked at any time during the work. Measurement of materials for Ready Mixed Concrete shall conform to the "Specifications for Ready Mixed Concrete" (A.S.T.M. Serial Designation: C94-38).*

e. Allowable Unit Stresses in Concrete. 1. The unit stresses in pounds per square inch on concrete to be used in the design shall not exceed the following values, where f'c equals the minimum ultimate compressive strength at 28 days.

2. The table gives, for convenience, the actual values for certain values of f'c and shall not preclude the use of other strength concretes if allowable stresses are determined on the same basis.

(See next page.)

f. Allowable Unit Stresses in Reinforcement. The following unit stresses in reinforcing steel shall not be exceeded:

Tension:

Intermediate grade billet steel .... $(f_s) = 20{,}000$ p.s.i.
Rail steel bars .... $(f_s) = 20{,}000$ p.s.i.
Web reinforcement .... $(f_s) = 20{,}000$ p.s.i.
Structural steel shapes .... $(f_s) = 18{,}000$ p.s.i.
Wire mesh or other steel reinforcement, not exceeding ¼ inch in diameter (used in one-way slabs), fifty per cent of the minimum yield point as established by the A.S.T.M. Standards for the particular grade of steel used; but not to exceed .... $(f_s) = 30{,}000$ p.s.i.

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*Wherever practicable such measurement shall be by weight rather than by volume.

Description		For any strength of concrete as fixed by test in accord. with Sec. 2704, b $n=\frac{30,000}{f'c}$	Allowable unit stresses When strength of concrete is fixed by the water-content in accordance with Sec. 2704, b			
			f'c= 2000 p.s.i. n=15	f'c= 2500 p.s.i. n=12	f'c= 3000 p.s.i. n=10	f'c= 3750 p.s.i. n=8
Flexure: f_c						
Extreme fiber stress in compression	f_c	0.40f'c	800	1000	1200	1500
Extreme fiber stress in compression adjacent to supports of continuous or fixed beams or of rigid frames	f_c	0.45f'c	900	1125	1350	1688
Shear: v						
Beams with no web reinforcement and without special anchorage of longitudinal steel	v_c	0.02f'c	40	50	60	75
Beams with no web reinforcement, but with special anchorage of longitudinal steel	v_c	0.03f'c	60	75	90	113
Beams with properly designed web reinforcement but without special anchorage of longitudinal steel	v	0.06f'c	120	150	180	225
Beams with properly designed web reinforcement and with special anchorage of longitudinal steel	v	0.12f'c	240	300	360	450
Flat slabs at distance d from edge of dropped panel**	v_c	0.03f'c	60	75	90	113
Footings where longitudinal bars have no special anchorage	v_c	0.02f'c	40	50	60	75
Footings where longitudinal bars have special anchorage	v_c	0.03f'c	60	75	90	113
Bend: u						
In beams and slabs and one-way footings:						
Plain bars or structural shapes	u	0.04f'c	80	100	120	150
Deformed bars	u	0.05f'c	100	125	150	188
In two-way footings:						
Plain bars or structural shapes	u	0.03f'c	60	75	90	113
Deformed bars	u	0.0375f'c	75	94	112	141
(Where special anchorage is provided [see Sec. 2711,c] one and one-half times these values in bond may be used)						
Bearing: f_c						
On full area	f_c	0.25f'c	500	625	750	938
On one-third area*	f_c	0.0375f'c	750	938	1125	1405

**See Section 2710, g for shear stress at edge of column capital.

*The allowable bearing stress on an area greater than one-third but less than the full area shall be interpolated between the values given.

Compression:

Structural steel section in composite columns	16,000 p.s.i.
Cast-iron section in composite columns	10,000 p.s.i.

NOTE: If special conditions require the use of Billet-Steel Concrete Reinforcement Bars of structural or hard grades, the allowable unit stress shall not exceed 18,000 p.s.i. for structural grade nor 20,000 p.s.i. for hard grade bars.

Sec. 2705. Mixing and placing concrete.

a. Preparation of Equipment and Place of Deposit. 1. Before placing concrete, all equipment for mixing and transporting the concrete shall be cleaned, all debris and ice shall be removed from the places to be occupied by the concrete, forms shall be thoroughly wetted (except in freezing weather) or oiled, and masonry filler units that will be in contact with concrete shall be well drenched (except in freezing weather), and the reinforcement shall be thoroughly cleaned of ice or other coatings.

2. Water shall be removed from place of deposit before concrete is placed unless otherwise permitted by the Superintendent.

b. Mixing Concrete. 1. The concrete shall be mixed until there is a uniform distribution of the materials and shall be discharged completely before the mixer is recharged.

2. For job mixed concrete, the mixer shall be rotated at a speed recommended by the manufacturers and mixing shall be continued for at least one minute after all materials are in the mixer. A longer mixing period may be required for mixers larger than one cubic yard capacity.

3. Ready mixed concrete shall be mixed and delivered in accordance with the requirements set forth in the "Tentative Specifications for Ready Mixed Concrete" (A. S. T. M. Serial Designation: C94-38).

c. Conveying. 1. Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of the materials.

2. Equipment for chuting, pumping, and pneumatically conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at the delivery and without separation of the materials.

d. Depositing. 1. Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to dropping, rehandling or flowing. No concrete that has partially hardened or been contaminated by foreign material shall be deposited on the work, nor shall retempered concrete be used.

2. When concreting is once started, it shall be carried on as a continuous operation until the placing of the panel or section is completed. The top surface shall be generally level. When construction joints are necessary, they shall be made in accordance with Section 2706, g.

3. All concrete shall be thoroughly compacted by suitable means during the operation of placing, and shall be thoroughly worked around reinforcement, embedded fixtures and into the corners of the forms.

4. Where conditions make compacting difficult, or where the reinforcement is congested, batches of mortar containing the same proportions of cement to sand as used in the concrete, shall first be deposited in the forms. The concreting shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the spaces between the bars.

e. Curing. In all concrete structures, provision shall be made for maintaining the concrete in a moist condition for a period of at least seven days after the placement of the concrete and for high early strength concretes, special moist curing shall be provided for at least the first three days of the seven day period after the placement of the concrete.

f. Cold weather requirements. 1. Adequate equipment shall be provided for heating the concrete materials and protecting the concrete during freezing or near-freezing weather. No frozen materials or materials containing ice shall be used.

2. All concrete materials and all reinforcement, forms, fillers, and ground with which the concrete is to come in contact shall be free from frost. Whenever the temperature of the surrounding air is below 40 degrees Fahrenheit all concrete placed in the forms shall have a temperature of between 70 degrees Fahrenheit and 100 degrees Fahrenheit and adequate means shall be provided for maintaining a temperature of at least 50 degrees Fahrenheit for not less than 72 hours after placing or for as much more time as is necessary to insure proper curing of the concrete. No dependence shall be placed on salt or other chemicals for the prevention of freezing. Manure, when used for protection shall not be applied directly to concrete.

Sec. 2706. Forms and details of construction.

a. *Removal of forms.* Forms shall be removed in such a manner and with such precautions as to insure complete safety of the structure.

b. *Pipes, conduits, etc., embedded in concrete.* Pipes which will contain liquid gas or vapor at other than room temperature shall not be embedded in concrete necessary for structural stability or fire protection. Drain pipes and pipes whose contents will be under pressure greater than atmospheric pressure by more than five pounds per square inch shall not be embedded in structural concrete except in passing through from one side to the other of a floor, wall or beam. Electric conduits and other pipes whose embedment is allowed shall not, with their fittings, displace that concrete of a column on which stress is calculated or which is required for fire protection, to greater extent than four per cent of the area of the cross section. Sleeves or other pipes passing through floors, wall or beams shall not be of such size or in such location as unduly to impair the strength of the construction; such sleeves or pipes may be considered as replacing structurally the displaced concrete, provided they are not exposed to rusting or other deterioration, are of uncoated iron or steel not thinner than standard electrical conduit, have a nominal inside diameter not over two inches, and are spaced not less than three diameters on centers. Sleeves more than 2 inches in diameter or spaced less than three diameters on centers shall have added reinforcement in the concrete. Embedded pipes or conduits other than those merely passing through, shall not be larger in outside diameter than one-third the thickness of the slab, wall or beam in which they are embedded; shall not be spaced closer than three diameters on centers, nor so located as unduly to impair the strength of the construction. Circular uncoated or galvanized electric conduit of iron or steel may be considered as replacing the displaced concrete.

c. *Bending reinforcement.* Metal reinforcement shall not be bent, straightened or handled in any manner that will injure the material. Reinforcement may be heated only when approved by the Superintendent. Cold bends shall be made around a pin having a diameter of not less than four times the diameter of the bar. Bars with kinks or bends not shown on the plans shall not be used.

d. *Placing reinforcement.* 1. Metal reinforcement shall be accurately placed and adequately secured in position by concrete or metal chairs and spacers. The minimum clear distance between parallel bars shall be 1½ times the diameter for round bars and twice the side dimension for square bars. If special anchorage as required in Sec. 2711, c, is provided, the minimum clear spacing between parallel bars shall be equal to the diameter for round bars and 1½ times the side dimension for square bars. In no case shall the clear spacing between bars be less than 1 inch, nor less than 1½ times the maximum size of the coarse aggregate.

2. When wire or other reinforcement not exceeding ¼ inch in diameter is used as reinforcement for slabs not exceeding ten feet in span, the reinforcement may be curved from a point near the top of the slab over the support to a point near the bottom of the slab at mid-span; provided such reinforcement is either continuous over, or securely anchored to the support.

e. Splices in reinforcement. 1. In slabs, beams and girders, splices of reinforcement shall generally be avoided at points of maximum stress and, where made, shall provide sufficient lap to transfer the stress by bond and shear or weld.

2. For splices in longitudinal reinforcement of columns see Section 2713, c, 3, c.

f. Protective covering of reinforcement. 1. At the underside of footings and elsewhere in concrete poured in contact with the ground, the main metal reinforcement shall have a minimum covering of three inches except that in floor slabs poured on dry earth such covering may be 1½ inch. In concrete poured in forms but exposed to soil backfill, moisture or weather, such covering shall be two inches. Metal chairs or spacers shall not be used.

2. In buildings of Type 1 and Type 2 construction, and in other reinforced concrete required to have specified fire resistance, main metal reinforcement shall be protected as required in Parts XVI to XXII inclusive and Part XXXVII.

3. Bars used for the support or spacing of reinforcement, shrinkage reinforcement, column ties and stirrups not over ½ inch in diameter, shall not be considered main reinforcement. Such bars may have minimum protective covering ½ inch less than specified in this section for main reinforcement.

g. Construction joints. Joints not indicated on the plans shall be so made and located as least to impair the strength of the structure. Such joints in floors shall be located near the middle of spans of slabs, beams, or girders, unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. At least two hours must elapse after depositing concrete in columns or walls before depositing in beams, girders, or slabs supported thereon. Beams, girders, brackets, column capitals, and haunches shall be considered part of the floor system and shall be placed monolithically therewith.

Sec. 2707. Design, general information.

a. Assumption. 1. The design of reinforced concrete members shall be made with reference to working stresses and safe loads. The accepted theory of flexure as applied to reinforced concrete shall be applied to all members resisting bending. The following assumptions shall be made:

2. At the section of maximum moment the steel takes all the tensile stress.

3. In determining the ratio for design purposes, the modulus of elasticity for the concrete shall be taken as 1000 f'c, and that for steel as 30,000,000 lbs. per square inch.

b. Design loads. The provisions for design herein specified are based on the assumption that all structures shall be designed for all dead- and live-loads coming upon them, the live-loads to be in accordance with Part XXIII, with such reductions for girders and lower story columns as are permitted therein.

c. Resistance to wind loads. 1. The resisting elements in structures required to resist wind forces shall be limited to the integral structural parts.

2. The moments, shears, and direct stresses resulting from wind forces determined in accordance with recognized methods shall be added to the maximum stresses which obtain at any section for dead- and live-loads.

3. In proportioning the component parts of the structure for the maximum combined stresses, including wind stresses, the unit stresses shall not exceed the allowable stresses for combined live- and dead-loads provided in Sections 2704, e and 2704, f by more than one-third. The structural members and their connections shall be so proportioned as to provide suitable rigidity of structure.

Sec. 2708. Flexural computations.

a. General requirements. 1. All members shall be designed to resist at all sections the maximum bending moments and shears produced by dead load, live load and wind load, as determined by the principle of continuity.

2. In the case of approximately equal spans with loads uniformly distributed, where the intensity of live load does not exceed three times the intensity of dead load, the clause is satisfied essentially by the following moments:

Negative moment at face of first interior support for beams and girders and for slabs exceeding 10 feet.

Two spans $\frac{1}{8} wl'^2$

More than two spans $\frac{1}{10} wl'^2$

For slabs not exceeding 10 feet in span

Two spans $\frac{1}{10} wl'^2$

More than two spans $\frac{1}{12} wl'^2$

Negative moment at face of other interior supports

$\frac{1}{12} wl'^2$

Positive moment at center of span

End spans $\frac{1}{10} wl'^2$

Interior spans $\frac{1}{12} wl'^2$

Shear in end members at first interior support $1.20 \frac{wl'}{2}$

Shear at other supports $\frac{wl'}{2}$

3. For the purposes of applying this method "approximately" shall be construed to mean that the longer of two adjacent spans shall not exceed the shorter by more than 20 per cent. In these expressions $1' =$ the clear span for positive moments and the average of the two adjacent clear spans for negative moment.

b. Conditions of design. 1. Permissible assumptions. The span length of freely supported beams and slabs shall be the clear span plus the depth of beam or slab, but shall not exceed the distance between centers of the supports. In the application of the principle of continuity, the following assumptions shall be permissible:

2. Consideration may be limited to combinations of dead load on all spans with full live load on two adjacent spans and with full live load on alternate spans.

3. Any reasonable and consistent assumptions may be made as to the relative stiffness of the floor construction and columns. In computing the relative stiffness of floors to columns, the value I of the floor members may be based on the entire concrete sections neglecting the reinforcement, and that of columns on the entire concrete section plus the transformed steel section. The moment of inertia assumed for the columns in computing bending moments must also be used in computing stresses.

4. The far ends of columns above and below the floor under consideration may be considered fixed.

5. When members are deepened near their ends by haunches they may be analyzed as members of constant section provided the minimum depth is used throughout in computing stresses due to bending; otherwise a complete analysis is required. Where members are widened near their supports the additional width shall be neglected in computing moments but may be used in computing stresses.

Additional section at the end may in any case be utilized in resisting shear.

6. Where slabs of uniform thickness are built integrally with their supports the span length may be taken equal to the clear span between faces of supports and the width of support otherwise neglected.

7. In the application of the principle of continuity, center to center distances may be used in the moment determination of all members.

Moments prevailing at the faces of support may be used to proportion the members at these sections.

c. Limitations. 1. Wherever at any section positive reinforcement is indicated by analysis, the amount provided shall be not less than .005 b′d except in slabs of uniform thickness.

2. Not less than .005 b′d of negative reinforcement shall be provided at the outer end of all members built integrally with their supports.

3. In slabs of uniform thickness the minimum amount of reinforcement in the direction of principal stress shall be.

For structural, intermediate and hard grades and rail steel	.0025 b'd
For steel having a minimum yield point of 56,000 lbs. per sq. inch	.002 b'd

d. Depth of beam or slab. The depth of the beam or slab shall be taken as the distance from the centroid of the tensile reinforcement to the compression face of the structural members. Any floor finish not placed monolithically with the floor slab shall not be included as a part of the structural member. When the finish is placed monolithically with the structural slab in buildings of the warehouse or industrial class, there shall be placed an additional depth of ½ inch over that required by the design of the member.

e. Distance between lateral supports. The clear distance between lateral supports of a beam of rectangular section shall not exceed 32 times the least width of compression flange.

f. Requirements for T-beams. 1. In T-beam construction the slab and beam shall be built integrally or otherwise effectively bonded together. The effective flange width to be used in the design of symmetrical T-beams shall not exceed one-fourth of the span length of the beam, and its overhanging width on either side of the web shall not exceed eight times the thickness of the slab nor one-half the clear distance to the next beam.

2. For beams having a flange on one side only, the effective overhanging flange width shall not exceed one-twelfth of the span length of the beam, nor six times the thickness of the slab, nor one-half the clear distance to the next beam.

3. Where the principal reinforcement in a slab which is considered as the flange of a T-beam (not a rib or ribbed floors) is parallel to the beam, transverse reinforcement shall be provided in the top of the slab. This reinforcement shall be designed to carry the load on the portion of the slab assumed as the flange of the T-beam. The

spacing of the bars shall not exceed 3 times the thickness of the flange, nor in any case 12 inches.

4. Provision shall be made for the compressive stress at the support in continuous T-beam construction, care being taken that the provisions of Section 2706, e, relating to the spacing of bars, and Section 2705, d, 4, relating to the placing of concrete shall be fully met.

5. The overhanging portion of the flange of the beam shall not be considered as effective in computing the shear and diagonal tension resistance of T-beams.

6. Isolated beams in which the T-form is used only for the purpose of providing additional compression area, shall have a flange thickness not less than one-half the width of the web and a total flange width not more than 4 times the web thickness.

g. One way ribbed floor construction. 1. Ribbed floor construction consists of concrete ribs and slabs placed monolithically with or without burned clay or concrete tile fillers. The ribs shall not be farther apart than 30 inches face to face. The ribs shall be straight, not less than 4 inches wide, nor of a depth more than 3 times the width.

2. The concrete slab over the fillers shall be not less than 1½ inches in thickness, nor less in thickness than one-twelfth of the clear distance between ribs. Shrinkage reinforcement in the slab shall be provided as required in Section 2708, h.

3. Where removable forms are used, the thickness of the concrete slab shall not be less than one-twelfth of the clear distance between ribs and in no case less than two inches. Such slabs shall be reinforced at right angles to the ribs with a minimum of .049 sq. in. of reinforcing steel per foot of width.

4. When the finish used as a wearing surface is placed monolithically with the structural slab in buildings of the warehouse or industrial class, the thickness of the concrete over the fillers shall be ½ inch greater than the thickness used for design purposes.

5. Where the slab contains conduits or pipes, the thickness shall not be less than 1½ inches plus the total over-all depth of such conduits or pipes at any point. Such conduits or pipes shall be so located as not to impair the strength of the construction.

h. Compression steel in flexural members. Where it is necessary to introduce steel in compression in girders, beams, or slabs, such steel shall be thoroughly anchored by ties or stirrups not less than ¼ inch in size which shall be spaced not more than 16 bar diameters nor 48 tie diameters apart over the distance where the compression steel is required.

i. Shrinkage and temperature reinforcement. Reinforcement for shrinkage and temperature stresses normal to the principal reinforcement shall be provided in floor and roof slabs where the principal reinforcement extends in one direction only. Such reinforcement shall provide for the following minimum ratios of reinforcement area to concrete area (bd), but in no case shall such reinforcing bars be placed farther apart than five times the slab thickness nor more than 18 inches:

Floor slabs where plain bars are used	0.0025
Floor slabs where deformed bars are used	0.002
Floor slabs where wire fabric is used, having welded intersections not farther apart in the direction of stress than 12 in.	0.0018
Roof slabs where plain bars are used	0.003
Roof slabs where deformed bars are used	0.0025
Roof slabs where wire fabric is used, having welded intersections not farther apart in the direction of stress than 12 inches	0.0022

j. Two-way slabs of reinforced concrete. 1. Concrete slabs, either solid, ribbed or combination slabs, supported on four sides by beams, girders or walls, and reinforced to span in two directions shall be designed in accordance with the provisions of this sub-section.

2. The slab shall be regarded as consisting of a series of adjacent strips of unit width spanning in each direction. In computations for shear and diagonal tension, bond, and for the loading of supporting members, each strip, spanning in either the longer or the shorter direction, shall be assumed to carry and transmit to its support a total load (W), represented by the expression:

$$W = \frac{1}{2} C\, rwL = \frac{1}{2} C_o\, w\, L_1$$

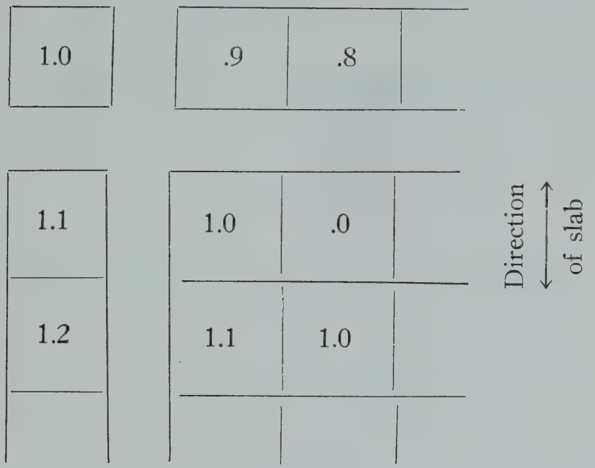
in which (w) is the load per unit area of the slab.

(L) is the span of the strip

(L_1) is the width of the panel transverse to the span

(r) is the ratio of L_1 to L

(C_0) is a coefficient dependent on the position of the panel relative to adjacent panels continuous with it at its ends and sides, as indicated on the accompanying diagram. Full restraint at an end support, shall be considered equivalent to continuity in determining (C_o).



Values of C_o in Various Panels

3. The positive bending moment for a strip of unit width in the middle half of the panel, spanning in either direction, shall be assumed as given by the following formula:

$$M = 3/10\ C_1\ C_o r^2\ w\ L^2 = 3/10\ C_1\ C_o\ w\ L^2_1$$

in which (C_1) is a coefficient for bending determined in accordance with the conditions of restraint at end supports of the strips as provided in sections 2708, a.

4. Negative moments at and adjacent to supports between two panels shall be determined by the formula given in paragraph 3 for positive moment taking (C_1) as the coefficient for negative moment determined according to section 2708, a, 1, and in case the conditions of continuity in the two panels are different, taking the mean value of (C_o).

5. The positive bending in strips of unit width in the outer quarters of the panel may be assumed to be three quarters that of the strips of the middle half.

6. Lines of inflection in a two-way panel shall be assumed at a distance of one fourth of its shorter span from supports over which the slab is continuous.

k. Maximum spacing of principal slab reinforcement. In slabs other than ribbed floor construction or flat slabs, the principal reinforcement shall not be spaced farther apart than 1½ times the slab thickness, nor shall the ratio of reinforcement be less than specified in section 2708, h.

Sec. 2709. Cinder concrete floor and roof slab.

1. Cinder concrete slabs for floor and roof construction may be used in Class 1 Fireproof Structures as hereinafter prescribed:

a. Cinder concrete slabs between supporting steel beams shall be not less than four inches thick. The steel supporting members shall be encased with concrete poured integrally with the slab. The encasement shall be not less than that required for fireproofing as specified in Part XVI and defined in Part XXXVII.

b. Cinder concrete shall consist of one part cement by volume, two parts sand by volume and a maximum of five parts of cinder aggregate measured separately by volume. Cinder aggregate shall be clean and well burned steam boiler cinders and shall not contain more than thirty-five per cent by weight of unconsumed carbon nor more than one and one-half per cent by weight of sulphur. Other aggregates shall conform to Section 2703.

c. Reinforcement shall consist of steel fabric, rods or other suitable shapes. The reinforcement shall be at least one and one-half per cent for continuous steel fabric and at least two and one-half per cent for other forms of steel reinforcement.

d. The minimum thickness of floor and roof slabs shall be determined by the following formula, in which t = total thickness in inches, L = clean span in feet between steel flanges, w = gross uniform load in pounds per square foot.

$$t = \frac{L}{2} + \frac{w - 75}{200}$$

The total thickness shall be at least four inches and may be used for spans of eight feet or less provided the gross load does not exceed two hundred pounds per square foot.

e. The safe carrying capacity of the construction shall be determined by the following formula, in which w = gross uniform load in pounds per square foot, A_s = cross sectional area of reinforcement in square inches per foot of width of slab, L = clear span in feet between steel flanges and shall not exceed ten feet in any case, and when the gross floor load exceeds two hundred pounds per square foot shall not exceed eight feet. C = the following coefficient, for steel having an ultimate strength of at least fifty-five thousand pounds per square inch:

(a) For cinder concrete.

(1) Twenty thousand when reinforcement is continuous.

(2) Fourteen thousand when reinforcement is hooked or attached to one or both supports.

$$w = \frac{3CA_s}{L^2}$$

2. When this formula is used the reinforcement shall be continuous or hooked over supports.

3. The cinder concrete shall have an ultimate compressive strength of at least seven hundred pounds per square inch at the end of 28 days and the working fibre stress in bending shall not exceed 200 pounds per square inch.

4. Conducts, pipes or other materials shall not be embedded in the slab, and all floor shall have a light weight aggregate fill on top at least three inches in depth.

Sec. 2710. Shear and diagonal tension.

a. Shearing Unit Stress. 1. The shearing unit stress (v) in reinforced concrete beams shall be computed by formula.

$$v = \frac{V}{bjd}$$

2. For beams of I or T section b′ shall be substituted for b.

3. In ribbed construction, where burned clay or concrete tile are used, b′ may be taken as a width equal to the thickness of the concrete web plus the thicknesses of the vertical shells of the concrete or burned clay tile in contact with the joist as in Section 2708 f.

4. When the value of the shearing unit stress computed by the formula above exceeds the shearing unit stress (v_c) permitted on the concrete of an unreinforced web (see Section 2704, e), web reinforcement shall be provided to carry the excess.

b. Types of Web Reinforcement. Web reinforcement may consist of:

1. Stirrups or web reinforcement bars perpendicular to the longitudinal steel.

2. Stirrups or web reinforcement bars welded or otherwise rigidly attached to the longitudinal steel and making an angle of 30 degrees or more thereto.

3. Longitudinal bars bent so that the axis of the inclined portion of the bar makes an angle of 15 degrees or more with the axis of the longitudinal portion of the bar.

4. Special arrangements of bars with adequate provisions to prevent slip of bars or splitting of the concrete by the reinforcement (see Section 2710, d, 6).

5. Stirrups or other bars to be considered effective as web reinforcement shall be anchored at both ends, according to the provisions of Section 2711, d.

c. Stirrups. 1. The area of steel required in stirrups placed perpendicular to the longitudinal reinforcement shall be computed by formula.

$$A_v = \frac{V's}{f_v\, jd}$$

2. Inclined stirrups shall be proportioned by formula in Section 2710, d, 4.

3. Stirrups placed perpendicular to the longitudinal reinforcement shall not be used alone as web reinforcement when the shearing unit stress (v) exceeds 0.08 f′c.

d. Bent bars. 1. When the web reinforcement consists of a single bent bar or of a single group of bent bars the required area of such bars shall be computed by formula.

$$A_v = \frac{V'}{f_v \sin \alpha}$$

2. In the above formula V′ shall not exceed 0.040 f′c bjd.

3. Only the center three-fourths of the inclined portion of such bar, or group of bars, shall be considered effective as web reinforcement.

4. Where there is a series of parallel bent bars, the required area shall be determined by formula.

$$A_v = \frac{V's}{f_v\, jd\, (\sin \alpha \cos \alpha)}$$

5. When bent bars, having a radius of bend of not more than two

times the diameter of the bar are used alone as web reinforcement the allowable shearing unit stress shall not exceed 0.060 f'_c. This shearing unit stress may be increased at the rate of 0.01 f'_c for each increase of four bar diameters in the radius of bend until the maximum allowable shearing unit stress is reached. (See section 2704, e).

6. The shearing unit stress permitted when special arrangements of bars are employed shall be that determined by making comparative tests, to destruction, of specimens of the proposed system and of similar specimens reinforced in conformity with the provisions of this code, the same factor of safety being applied in both cases.

e. Combined web reinforcement. Where more than one type of reinforcement is used to reinforce the same portion of the web, the total shearing resistance of this portion of the web shall be assumed as the sum of the shearing resistances computed for the various types separately. In such computations the shearing resistance of the concrete shall be included only once, and no one type of reinforcement shall be assumed to resist more than $\frac{2V'}{3}$.

f. Spacing of Web Reinforcement. Where web reinforcement is required it shall be so spaced that every 45 degree line (representing a potential crack) extending from the mid-depth of the beam to the longitudinal tension bars shall be crossed by at least one line of web reinforcement. If a shearing unit stress in excess of $0.06f'_c$ is used, every such line shall be crossed by at least two such lines of web reinforcement.

g. Shearing Stress in Flat Slabs. In flat slabs, the shearing unit stress on a vertical section which lies at a distance $t_1 - 1\frac{1}{2}$ in. beyond the edge of the column capital and parallel with it, shall not exceed the following values when computed by formula in Section 2710, a (in which d shall be taken as $t_1 - 1\frac{1}{2}$ in.):

(1) $0.03f'_c$, when at least 50 per cent of the total negative reinforcement passes directly over the column capital.

(2) $0.025f'_c$, when 25 per cent of the total negative reinforcement passes directly over the column capital.

(3) For intermediate percentages, intermediate values of the shearing unit stress shall be used.

In flat slabs, the shearing unit stress on a vertical section which lies at a distance of $t_2 - 1\frac{1}{2}$ in. beyond the edge of the dropped panel and parallel with it shall not exceed $0.03f'_c$ when computed by formula in Section 2710, a (in which d shall be taken as t_2-1½ in.). At least 50 per cent of the cross-sectional area of the negative reinforcement in the column strip must be within the width of strip directly above the dropped panel.

h. Shear and Diagonal Tension in Footings. The shearing unit stress computed by formula in Section 2710, a, on the critical section shall not exceed $0.02 f'_c$ for footings with straight bars, nor $0.03 f'_c$ for footings in which the bars are anchored at both ends by adequate hooks or as otherwise specified in Section 2711, e.

Sec. 2711. Bond and anchorage.

a. Computation of Bond Stress in Beams. 1. In flexural member in which the tensile reinforcement is parallel to the compression face, the bond stress at any cross section shall be computed by formula.

$$u = \frac{V}{\Sigma ojd}$$

in which V is the shear at that section.

2. Adequate end anchorage shall be provided for the tensile reinforcement in all flexural members to which the formula does not apply, such as footings, brackets and other tapered or stepped beams in which the tensile reinforcement is not parallel to the compression face.

b. Ordinary Anchorage Requirements. 1. Tensile negative reinforcement in any span of a continuous restrained, or cantilever beam, or in any member of a rigid frame shall be adequately anchored by bond, hooks or mechanical anchors in or through the supporting member. Within any such span every reinforcing bar shall be extended at least 12 diameters beyond the point at which it is no longer needed to resist stress. In cases where the length from the point of maximum tensile stress in the bar to the end of the bar is not sufficient to develop this maximum stress by bond, the bar shall extend into a region of compression and be anchored by means of a standard hook or it shall be bent across the web at an angle of not less than 15 degrees with the longitudinal portion of the bar and either made continuous with the positive reinforcement or anchored in a region of compression.

2. Of the positive reinforcement in continuous beams not less than one-fourth the area shall extend along the same face of the beam into the support a distance of ten or more bar diameters, or shall be

extended as far as possible into the support and terminated in standard hooks.

3. In simple beams, or at the outer ends of freely supported ends span of continuous beams, at least one-half the positive reinforcement shall extend along the same face of the beam into the support a distance of ten or more bar diameters, or shall be extended as far as possible into the support and terminated in standard hooks.

c. Special Anchorage Requirements. Where increased shearing or bond stresses are permitted because of the use of special anchorage (see Section 2704, e), every bar shall be terminated in a standard hook in a region of compression, or it shall be bent across the web at an angle of not less than 15 degrees with the longitudinal portion of the bar and made continuous with the negative or positive reinforcement.

d. Anchorage of Web Reinforcement. 1. The stress in a stirrup or web reinforcement bar for resistance of diagonal tension in a beam shall not exceed the capacity of its anchorage in the upper or lower half of the effective depth of the beam nor the allowable stress specified in Section 2704, f.

2. Web reinforcement which is provided by bending into an inclined position one or more bars of the main tensile reinforcement where not required for resistance to positive or negative bending shall be considered completely anchored by continuity with the main tensile reinforcement or by embedment of requisite length in the upper or lower half of the beam, provided at least one half of such embedment is as close to the upper or lower surface of the beam as the requirements of fire or rust protection allow. A hook placed close to the upper or lower surface of the beam may be substituted for a portion of such embedment.

3. Stirrups shall be anchored at both ends by one of the following methods or by a combination thereof:

a. Rigid attachment, as by welding, to the main longitudinal reinforcement. The capacity of this anchorage is limited to that of the attachment.

b. Bending around and closely in contact with a bar of the main longitudinal reinforcement in the form of a U-stirrup or a hook. The capacity of this anchorage may be taken as sixteen thousand pounds per square inch in the stirrup.

c. A hook placed as close to the upper or lower surface of the beam as the requirement for fire and rust protection will allow. The capacity of this anchorage shall be ten thousand pounds per square inch in the stirrup plus the stress developed by bond between mid-height of the effective depth of the beam and the beginning of bending of the hook.

d. A length of embedment in the upper or lower half of the effective depth of the beam, whether straight or curved. The capacity of this anchorage shall be limited to the stress developed by bond on the embedded length. Anchorage of this type shall not be used on stirrups where the unit shear exceeds $(0.06f'_c)$.

e. Anchorage of Bars in Footing Slabs. All bars in footing slabs, except the longitudinal reinforcement between loads in continuous slab footings, shall be anchored by means of standard hooks. The outer faces of these hooks shall be not less than three inches nor more than six inches from the face of the footing.

f. Hooks. 1. The terms "hook" or "standard hook" as used herein shall mean a complete semicircular turn with a radius of bend on the axis of the bar of not less than three and not more than six bar diameters, plus an extension of at least four bar diameters at the free end of the bar. Hooks having a radius of bend of more than six bar diameters shall be considered merely as extensions to the bars.

2. In general, hooks shall not be permitted in the tension portion of any beam except at the ends of simple or cantilever beams or at the freely supported ends of continuous or restrained beams.

3. No hook shall be assumed to carry a load which would produce a tensile stress in the bar greater than 10,000 lbs. per sq. in.

4. Any mechanical device capable of developing the strength of the bar without damage to the concrete may be used in lieu of a hook. Tests must be presented to show the adequacy of such devices.

Sec. 2712. Flat slabs, with square or rectangular panels.

a. Notation. A = The distance from the center line of the column, in the direction of any span, to the intersection of a 45-degree diagonal line from the center of the column to the bottom of the flat slab or drop panel, where such line lies wholly within the column, capital, or bracket, provided such capital or bracket is structurally capable of resisting shears and moments without excessive unit stress. In no case shall A be greater than one-eighth the span in the direction considered.

b. Scope. 1. The term flat slab shall mean a reinforced concrete slab supported by columns with or without flaring heads or column capitals, with or without depressed or drop panels and generally without beams or girders.

2. Recesses or pockets in flat slab ceilings, located between reinforcing bars and forming cellular or two-way ribbed ceilings, whether left open or filled with permanent fillers, shall not prevent a slab from being considered a flat slab; but allowable unit stresses shall not be exceeded.

3. This chapter provides for two methods of design of flat slab structures.

a. Any type of flat slab construction may be designed by application of the principles of continuity, using the method outlined in Section 2712, c, or using other recognized methods of elastic analysis. In either case, the design must be subject to the provisions of Section 2712, g, 2712, i, 2712, j.

b. The common cases of flat slab construction described in Section 2712, d, may be designed by the use of moment coefficients given in Sections 2712, d, and 2712, e, and subject to the provisions of Sections 2712, f, 2712, g, 2712, h, 2712, i, 2712, j.

c. Design of Flat Slabs as Continuous Frames. 1. Except in the cases of flat slab construction where specified coefficients for bending may be used, as provided in Section 2712, d, bending and shear in flat slabs and their supports shall be determined by an analysis of the structure as a continuous frame, and all sections shall be proportioned to resist the moments and shears thus obtained. In the analysis, the following assumptions may be made:

2. The structure may be considered divided into a number of bents, each consisting of a row of columns and strips of supported slabs, each strip bounded laterally by the center line of the panel on either side of the row of columns. The bents shall be taken longitudinally and transversely of the building.

3. Each such bent may be analyzed in its entirety; or each floor thereof and the roof may be analyzed separately with its adjacent columns above and below, the columns being assumed fixed at their remote ends. Where slabs are thus analyzed separately, in bents more than four panels long, it may be assumed in determining the bending at a given support that the slab is fixed at any support two panels distant therefrom beyond which slab continues.

4. The joints between columns and slabs may be considered rigid and this rigidity may be assumed to extend in the slabs a distance A from the center of the columns, and in the column to the intersec-

tion of the sides of the column and the 45 degree line defining A. The change in length of columns and slabs due to direct stress, and deflections due to shear, may be neglected. Where metal column capitals are used, account may be taken of their contributions to stiffness and resistance to bending and shear.

5. The supporting columns may be assumed free from settlement or lateral movement unless the amount thereof can be reasonably determined.

6. The moment of inertia of slab or column at any cross-section may be assumed to be that of the gross section of the concrete. Variation in the moments of inertia of the slabs and columns along their axes shall be taken into account.

7. Where the load to be supported is definitely known, the structure shall be analyzed for that load. Where the live load is variable but does not exceed three-quarters of the dead load, or the nature of the live load is such that all panels will be loaded simultaneously, the maximum bending may be assumed to obtain at all sections under full live load. Elsewhere, maximum positive bending near mid-span of a panel may be assumed to obtain under full live load in the panel and in alternate panels; and maximum negative bending at a support may be assumed to obtain under full live load in the adjacent panels only.

8. Where neither beams nor girders help to transfer the slab load to the supporting column, the critical section for negative bending may be assumed as not more than the distance xL from the column center, where

$$x = 0.073 + 0.57 \frac{A}{L}$$

In slabs supported by beams, girders, or walls, the critical section for negative bending shall be assumed at the face of such support.

9. The numerical sum of the maximum positive and the average maximum negative bending moments for which provision is made in the design in the direction of either side of a rectangular panel shall be assumed as not less than

$$\frac{1}{10} WL \left(1 - \frac{4\ Aav}{3L} \right)^{2}$$

10. The bending at critical sections across the slabs of each bent may be apportioned between the column strip and middle strip, as de-

fined in Section 2712, f, in the ratio of the specified coefficients which affect such apportionment in the special cases of flat slabs provided for in Section 2712, d.

11. The maximum bending in columns may be assumed to obtain under full live load in alternate panels. Columns shall be proportioned to resist the maximum bending combined with the maximum direct load consistent therewith; and for maximum direct load combined with the bending under full load, the direct load subject to allowable reductions, in the manner provided in Section 2713.

12. The foregoing provisions outline the method to be followed in analyzing and designing flat slabs in the general case. In all instances the design must conform to the requirements for panel strips and critical design sections, slab thickness and drop panels, capitals and brackets, arrangement of reinforcement and openings in flat slabs, as provided in Sections 2712, g, to 2712, j, inclusive.

d. Design of Flat Slabs by Moment Coefficients. 1. In those cases of flat slab construction which fall within the following limitations as to continuity and dimensions, the bending moments at critical sections may be determined by the use of specified coefficients as provided in Section 2712, e.

a. The ratio of length to width of panel does not exceed 1.3.
b. The slab is continuous for at least three panels in each direction.
c. The successive span lengths in each direction differ by not more than twenty per cent of the shorter span.

2. In such slabs, the numerical sum of the positive and negative bending moments in the direction of either side of an interior rectangular panel shall be assumed as not less than

$$M_0 = 0.09\ WL \left(1 - \frac{2c}{3L} \right)^2$$

3. Three-fourths of the width of the strip shall be taken as the width of the section in computing compression due to bending, except that, on a section through a drop panel, three-fourths of the width of the drop panel shall be taken. Account shall be taken of any recesses which reduce the compressive area.

4. The design of slabs under the procedure given in this section is subject to the provisions of all subsequent sub-sections of this section (Sections 2712, e, to 2712, j).

e. Bending Moment Coefficients. 1. The bending moments at the critical sections of the middle and column strips of an interior panel shall be assumed as given in Table 2712 A.

TABLE 2712A—BENDING MOMENTS IN INTERIOR FLAT SLAB PANEL

With drop panel		
Column strip	Negative moment	$0.50M_0$
	Positive moment	$0.20M_0$
Middle strip	Negative moment	$0.15M_0$
	Positive moment	$0.15M_0$
Without drop panel		
Column strip	Negative moment	$0.46M_0$
	Positive moment	$0.22M_0$
Middle strip	Negative moment	$0.16M_0$
	Positive moment	$0.16M_0$

TABLE 2712B—BENDING MOMENTS IN EXTERIOR FLAT SLAB PANEL

With drop panel		
Column strip	Exterior negative	$0.45M_0$
	Positive moment	$0.25M_0$
	Interior Negative	$0.55M_0$
Middle strip	Exterior negative	$0.10M_0$
	Positive moment	$0.19M_0$
	Interior negative	$0.165M_0$
Without drop panel		
Column strip	Exterior negative	$0.41M_0$
	Positive moment	$0.28M_0$
	Interior negative	$0.50M_0$
Middle strip	Exterior negative	$0.10M_0$
	Positive moment	$0.20M_0$
	Interior negative	$0.176M_0$

TABLE 2712C—BENDING MOMENTS IN PANELS WITH MARGINAL BEAMS OR WALLS

		Marginal Beams with Depth greater than 1½ times the Slab Thickness; or Bearing Wall		Marginal Beams with depth 1½ times the Slab Thickness or less	
(a) Load to be carried by Marginal Beam or Wall		Loads directly superimposed upon it plus a uniform load equal to one-quarter of the total live and dead panel load.		Loads directly superimposed upon it exclusive of any panel load	
(b) Moment to be used in the design of Half Column Strip adjacent and parallel to Marginal Beam or Wall.		With Drop	Without Drop	With Drop	Without Drop
	Neg.	$0.125M_0$	$0.115M_0$	$0.25M_0$	$0.23M_0$
	Pos.	$0.05M_0$	$0.055M_0$	$0.10M_0$	$0.11M_0$
(c) Negative Moment to be used in Design Strip continuous across a Beam or Wall	Neg.	$0.195M_0$	$0.208M_0$	$0.15M_0$	$0.16M_0$

2. The bending moments at critical section of strips, in an exterior panel, at right angles to the discontinuous edge, where the exterior supports consist of reinforced concrete columns or reinforced concrete bearing walls integral with the slab, the ratio of stiffness of the support to that of the slab being at least as great as the ratio of the live load to the dead load and not less than one shall be assumed as given in Table 2712 B. Where a flat slab is so supported by a wall providing restraint at the discontinuous edge, the coefficient for negative bending at the edge shall be assumed more nearly equal in the column and middle strips, the sum remaining as given in Table 2712 B, but that for the column strip shall not be less than $0.30M_0$. Bending in middle strips parallel to a discontinuous edge, except in a corner panel, shall be assumed the same as in an in-

terior panel. M_0 shall be determined as provided in Section 2712, d, 2, for an interior panel.

3. The bending moments at critical sections of strips, in an exterior panel, at right angles to the discontinuous edge, where the exterior supports are masonry bearing walls or other construction which provide only negligible restraint to the slab, shall be assumed as given in Table 2712 B, with the following modifications.

   a. On critical sections at the face of the exterior support, negative bending in each strip shall be assumed as 0.05 M_0.
   b. The coefficients for positive bending shall be increased by forty per cent.
   c. The coefficients for negative bending at the first interior columns shall be increased thirty per cent.

4. The bending moments in panels with marginal beams or walls in the strips parallel and close thereto, and in the beams, shall be determined upon the basis of assumptions presented in Table 2712 C.

5. For design purposes any of the moment coefficients of Tables 2712 A, 2712 B, and 2712 C may be varied by not more than six per cent, but the numerical sum of the positive and negative moments in a panel shall not be taken as less than the amount specified.

6. Panels supported by marginal beams on opposite edges shall be designed as solid one or two-way slabs to carry the entire panel load.

7. The ratio of reinforcement in any strip shall not be less than 0.0025.

f. Panel Strips and Critical Design Sections. 1. A flat slab panel shall be considered as consisting of strips in each direction as follows:

A middle strip one half panel in width, symmetrical about panel center line and extending through the panel in the direction of the span for bending.

A column strip consisting of the two adjacent quarter-panels either side of the column center lines.

2. The critical section for bending are located as follows: Sections for negative bending shall be taken along the edges of the panel, on column center lines between capitals and around the perimeters of column capitals.

Sections for positive bending shall be taken at mid-span of the strips.

3. Only the reinforcement which crosses a critical section within a strip may be considered effective to resist bending in the strip at that section. Reinforcement which crosses such section at an angle

with the center-line of the strip shall be assumed to contribute to the resistance of bending only its effective area in the direction of the strip, as defined in Section 2702.

g. Slab Thickness and Drop Panels. 1. The thickness of a flat slab and the size and thickness of the drop panel, where used, shall be such that the compressive stress due to bending at the critical sections of any strip and the shear about the column capital and the drop panel shall not exceed the unit stresses allowed in concrete of the quality used.

2. The shearing stresses in the slab outside the capital or drop panel shall be computed as provided in Section 2710, g.

3. Slab thickness shall not, however, be less than

$\frac{L}{40}$ with drop panels

or

$\frac{L}{36}$ without drop panels.

4. The thickness of the drop panel below the slab shall not be more than one-fourth the distance from the edge of the column capital to the edge of the drop panel.

h. Capitals and Brackets. 1. Where a column is without a flaring concrete capital the distance c shall be taken as the diameter of the column. Structural metal embedded in the slab or drop panel may be regarded as contributing to resistance in bending and shear.

2. Where a reinforced concrete beam frames into a column without capital or bracket on the same side with the beam, the value of c may be taken as the width of the column plus twice projection of the beam above or below the slab or drop panel for computing bending in strips parallel to the beam.

3. Brackets capable of transmitting the negative bending and the shear in the column strips to the columns without excessive unit stress may be substituted for column capitals at exterior columns. The value of c where brackets are used shall be taken as twice the distance from the center of the column to a point where the bracket is 1½ inches thick, but not more than the thickness of the column plus twice the depth of the bracket.

4. The average of the diameters c of the column capitals at the four corners of a panel shall be used in determining the bending in

the middle strips of the panel. The average of the diameters c of the two column capitals at the ends of a column strip shall be used in determining bending in the strip.

i. Arrangement of Reinforcement. 1. Slab reinforcement shall be provided to resist the bending and bond stresses not only at critical sections, but also at intermediate sections.

2. Bars shall be spaced evenly across strips or bands and the spacing shall not exceed three times the slab thickness.

3. In the exterior panels the reinforcement perpendicular to the discontinuous edge for positive bending, shall extend to the edge and have embedment of at least six inches in spandrel beams, walls or columns. All such reinforcement for negative bending shall be bent, hooked or otherwise anchored in spandrel beams, walls or columns.

j. Openings in Flat Slabs. Openings of any size may be cut through a flat slab if provision is made for the total positive and negative resisting moments, as required in Sections 2712, c, 2712, d, without exceeding the allowable stresses as given in Sections 2704, e, and 2704, f.

Sec. 2713. Reinforced concrete columns and walls.

a. Limiting Dimensions. The following sections on reinforced concrete and composite columns, except Section 2713, g, 1, apply to a short column for which the unsupported length is not greater than ten times the least dimension. When the unsupported length exceeds this value, the design shall be modified as shown in Section 2713, g, 1. Principal columns in buildings shall have a minimum diameter of twelve inches, or in the case of rectangular columns, a minimum thickness of ten inches, and a minimum gross area of 120 sq. in. Posts that are not continuous from story to story shall have a minimum diameter or thickness of six inches.

b. Unsupported Length of Columns. 1. For purposes of determining the limiting dimensions of columns the unsupported length of reinforced concrete columns shall be taken as the clear distance between floor slabs, except that

- a. In flat slab construction, it shall be the clear distance between the floor and the lower extremity of the capital.
- b. In beam and slab construction, it shall be the clear distance between the floor and the under side of the deeper beam framing into the column in each direction at the next higher floor level.

c. In columns restrained laterally by struts, it shall be the clear distance between consecutive struts in each vertical plane; provided that to be an adequate support, two such struts shall meet the column at approximately the same level, and the angle between vertical planes through the struts shall not vary more than 15 degrees from a right angle. Such struts shall be of adequate dimensions and anchorage to restrain the column against lateral deflection.

d. In columns restrained laterally by struts or beams, with brackets used at the junction, it shall be the clear distance between the floor and the lower edge of the bracket, provided that the bracket width equals that of the beam or strut and is at least half that of the column.

2. For rectangular columns, that length shall be considered which produces the greatest ratio of length to depth of section.

c. *Spirally Reinforced Columns.* 1. Allowable Load—The maximum allowable axial load, P, on columns with closely spaced spirals enclosing a circular concrete core reinforced with longitudinal bars shall be that given by the following formula:

$$P = A_g\ (0.225\ f'_c + f_s p_g)$$

Wherein A_g = the gross area of the column

f'_c = compressive strength of the concrete

f_s = nominal working stress in vertical column reinforcement, to be taken at forty per cent of the minimum specification value of the yield point; viz., 16,000 p. s. i. for intermediate grade steel and 20,000 p. s. i. for rail or hard grade steel.

p_g = ratio of the effective cross-sectional area of vertical reinforcement to the gross area, A_g.

2. Vertical Reinforcement—The ratio p_g shall not be less than 0.01 nor more than 0.08. The minimum number as bars shall be six; and the minimum diameter shall be 5/8 in. The center to center spacing of bars within the periphery of the column core shall not be less than 2½ times the diameter for round bars or three times the side dimension for square bars. The clear spacing between bars shall not be less than 1½ inches or 1½ times the maximum size of the coarse aggregate used. These spacing rules also apply to adjacent pairs of bars at a lapped splice; each pair of lapped bars forming a splice may be in contact, but the minimum clear spacing between one splice and the adjacent splice should be that specified for adjacent single bars.

3. Splices in Vertical Reinforcement—Where lapped splices in the column verticals are used, the minimum amount of lap shall be as follows:

a. For deformed bars—with concrete having a strength of 3000 p. s. i. or above, twenty-four diameters of bar of intermediate grade steel and thirty diameters of bar of hard grade steel. For bars of higher yield point, the amount of lap shall be increased in proportion to the nominal working stress. When the concrete strengths are less than 3000 p. s. i., the amount of lap shall be one-third greater than the values given above.

b. For plain bars—the minimum amount of lap shall be twenty-five per cent greater than that specified for deformed bars.

c. Welded splices or other positive connections may be used instead of lapped splices. Welded splices shall preferably be used in cases where the bar diameter exceeds 1¼ in. An approved welded splice shall be defined as one in which the bars are butted and welded and that will develop in tension at least the yield point stress on the reinforcing steel used.

d. Where changes in the cross section of a column occur, the longitudinal bars shall be offset in a region where lateral support is afforded by a concrete capital, floor slab or by metal ties or reinforcing spirals. Where bars are offset, the slope of the inclined portion from the axis of the column shall not exceed 1 in 6 and the bars above and below the offset shall be parallel to the axis of the column.

4. Spiral Reinforcement—The ratio of spiral reinforcement, p′, shall not be less than the value given by the following formula.

$$p' = 0.45\ (R-1)\ \frac{f'_c}{f'_s}$$

Wherein p' = ratio of volume of spiral reinforcement to the volume of the concrete core (out to out of spirals).

R = ratio of gross area to core area of column, A_g/A_c.

f'_s = useful limit stress of spiral reinforcement, to be taken as 40,000 p. s. i. for hot rolled rods of intermediate grade, 50,000 p. s. i. for rods of hard grade, and 60,000 p. s. i. for cold drawn wire.

The spiral reinforcement shall consist of evenly spaced continuous spirals held firmly in place and true to line by at least three vertical spacer bars. The spirals shall be of such size and so assembled as to permit handling and placing without being distorted from the designed dimensions. The material used in spirals shall have a minimum diameter of ¼ in. rolled bars or No. 4 W. & M. gage for drawn wire. Anchorage of spiral reinforcement shall be provided by 1½ extra turns of spiral rod or wire at each end of the spiral unit. Splices, when necessary shall be made in spiral rod or wire by welding or by a lap of 1½ turns. The center to center spacing of the spirals shall not exceed one-sixth of the core diameter. The clear spacing between spirals shall not exceed three in. nor be less than 1⅜ in. or 1½ times the maximum size of coarse aggregate used. The reinforcing spiral shall extend from the floor level in any story or from the top of the footing in the basement, to the level of the lowest horizontal reinforcement in the slab, drop panel or beam above. In a column with a capital, it shall extend to a plane at which the diameter or width of the capital is twice that of the column.

5. Protection of Reinforcement—The column reinforcement shall be protected everywhere by a covering of concrete cast monolithically with the core, for which the thickness shall not be less than 1½ in. nor less than 1½ times the maximum size of the coarse aggregate, nor shall it be less than required by the fire protection and weathering provisions of Section 2706, g.

6. Isolated Column with Multiple Spirals—In case two or more interlocking spirals are used in a column, the outer boundary of the column shall be taken as a rectangle of which the sides are outside the extreme limits of the spiral at a distance equal to the requirements for protective covering, as listed in Section 2706, g.

7. Equivalent Circular Columns—As an exception to the general procedure of utilizing the full gross area of the column section, it shall be permissible to design a circular column and to build it with a square, octagonal, or other shaped section of the same least lateral dimension. In such case, the allowable load, the gross area considered, and the required percentages of reinforcement shall be taken as those of the circular column.

d. Tied Columns. 1. Allowable Load—The maximum allowable axial load on columns reinforced with longitudinal bars and separate lateral ties shall be 80 per cent of that given by Formula, Sec. 2713, c, 1. The ratio, p_g, to be considered in tied columns shall not be less than 0.01 nor more than 0.04. The longitudinal reinforcement shall consist of at least four bars, of minimum diameter of ⅝ inch. Splices in reinforcing bars shall be made as described in Section 2713, c, 3.

2. Lateral Ties—Lateral ties shall be at least ¼ inch in diameter and shall be spaced apart not over 16 bar diameters, 48 tie diameters or the least dimension of the column. When there are more than four vertical bars, additional ties shall be provided so that every longitudinal bar is held firmly in its designed position and has lateral support equivalent to that provided by a 90-degree corner of a tie.

3. Limits of Column Section—In a tied column which for architectural reasons has a larger cross section than required by considerations of loading, a reduced affective area, A_g, not less than one-half of the total area may be used in applying the provisions of Section 2713, d, 1.

e. Composite Columns. 1. Allowable Load—The allowable load on a composite column, consisting of a structural steel or cast-iron column thoroughly encased in concrete reinforced with both longitudinal and spiral reinforcement, shall not exceed that given by the following formula.

$$P = 0.225\ A_c f'_c + f_s A_s + f_r A_r$$

Wherein A_c = net area of concrete section.
$= A_g - A_s - A_r$
A_s = cross-sectional area of longitudinal bar reinforcement.
A_r = cross-sectional area of the steel or cast-iron core.
f_r = allowable unit stress in metal core, not to exceed 16,000 p. s. i. for a steel core; or 10,000 p. s. i. for a cast-iron core.

The remaining notation is that of Section 2713, c.

2. Details of Metal Core and Reinforcement—The cross-sectional area of the metal core shall not exceed 20 per cent of the gross area of the column. If a hollow metal core is used it shall be filled with concrete. The amounts of longitudinal and spiral reinforcement and the requirements as to spacing of bars, details or splices and thickness of protective shell outside the spiral shall conform to the limiting values specified in Sections 2713, c, 2; 2713, c, 3; and 2713, c, 4. A clearance of at least three inches shall be maintained between the spiral and the metal core at all points except that when the core consists of a structural steel H-column, the minimum clearance may be reduced to 1½ inches.

3. Splices and Connections of Metal Cores—Metal cores in composite columns shall be accurately milled at splices and positive provision shall be made for alignment of one core above another. At

the column base, provision shall be made to transfer the load to the footing at safe unit stresses in accordance with Section 2704, e. The base of the metal section shall be designed to transfer the load from the entire composite column to the footing, or it may be designed to transfer the load from the metal section only, provided it is so placed in the pier or pedestal as to leave ample section of concrete above the base for the transfer of load from the reinforced concrete section of the column by means of bond of the vertical reinforcement and by direct compression on the concrete. Transfer of loads to the metal core shall be provided for by the use of bearing members such as billets, brackets or other positive connections, these shall be provided at the top of the metal core and at intermediate floor levels where required. The column as a whole shall satisfy the requirements of formula in Section 2713, e, 1, at any point; in addition to this, the reinforced concrete portion shall be designed to carry, in accordance with formula in Section 2713, c, 1, all floor loads brought onto the column at levels between the metal brackets or connections. In applying formula in Section 2713, c, 1, the value of A_g shall be interpreted as the area of the concrete section outside the metal core, and the allowable load on the reinforced concrete section shall be further limited to 0.35 f'_cA_g. Ample section of concrete and continuity of reinforcement shall be provided at the junction with beams or girders

4. Allowable Load on Metal Core Only—The metal cores of composite columns shall be designed to carry safely any construction or other loads to be placed upon them prior to their encasement in concrete.

f. Combination Columns. 1. Steel Columns Encased in Concrete—The allowable load on a structural steel column which is encased in concrete at least 2½ inches thick over all metal (except rivet heads) reinforced as hereinafter specified, shall be computed by the following formula.

$$P = A_rf'_r\left(1 + \frac{A_g}{100\,A_r}\right)$$

Wherein A_r = cross-sectional area of steel column.
f'_r = allowable stress for unencased steel column.
A_g = total area of concrete section.

The concrete used shall develop a compressive strength, f'_c, of at least 2,000 p. s. i. at 28 days. The concrete shall be reinforced by (the equivalent of) welded wire mesh having wires of No. 10 W.

and M. gage, the wires encircling the column being spaced not more than four inches apart and those parallel to the column axis not more than eight inches apart. This mesh shall extend entirely around the column at a distance of at least one inch inside the outer concrete surface and shall be lap-spliced at least forty wire diameters and wired at the splice. Special brackets shall be used to receive the entire floor load at each floor level. The steel column shall be designed to carry safely any construction or other loads to be placed upon it prior to its encasement in concrete.

2. Pipe Columns—The allowable load on columns consisting of steel pipe filled with concrete shall be determined by this formula.

$$P = 0.225\, f'_c A_c + f'_r A_r$$

The value of f'_r shall be given by the following formula.

$$f'_r = \left(18{,}000 - 70\frac{h}{K}\right) F$$

Wherein f'_r = allowable unit stress in metal core.
h = unsupported length of column.
K = least radius of gyration of metal core section.

$$F = \frac{\text{yield point of pipe}}{45{,}000}$$

If the yield point of the pipe is not known, the factor F shall be taken as 0.5.

g. Long Columns. The maximum allowable load P′ on axially loaded reinforced concrete or composite columns having a length, h, greater than ten times the least lateral dimension, d, shall be given by the following formula.

$$P' = P\left(1.3 - .03\frac{h}{d}\right)$$

Where P is the allowable axial load on a short column as given by formula in Section 2713, c, 1 and formula in Section 2713, e, 1.

The maximum allowable load P′ on eccentrically loaded columns in which $\frac{h}{d}$ exceeds ten shall also be given by formula in Sect. 2713, g, in which P is the allowable eccentrically applied load on a short column as determined by the provisions of Sections 2713, i, and 2713, j. In long columns subjected to definite bending stresses, as determined in Section 2713, h, the ratio $\frac{h}{d}$ shall not exceed twenty.

h. Bending Moments in Columns. The bending moments in the columns of all reinforced concrete structures shall be determined on the basis of loading conditions and restraint and shall be provided for in the design. When the stiffness and strength of the columns are utilized to reduce moments in beams, girders, or slabs, as in the case of rigid frames, or in other forms of continuous construction wherein column moments are unavoidable, they shall be provided for in the design. In building frames, particular attention shall be given to the effect of unbalanced floor loads on both exterior and interior columns and of eccentric loading due to other causes. Wall columns shall be designed to resist moments produced by:

1. Loads on all floors of the building.
2. Loads on a single exterior bay at two adjacent floor levels, or
3. Loads on a single exterior bay at one floor level.

Resistance to bending moments at any floor level shall be provided by distributing the moment between the columns immediately above and below the given floor in proportion to their relative stiffnesses and conditions of restraint.

i. Determination of Combined Axial and Bending Stresses. 1. In a reinforced concrete column, designed by the methods of this Section, which is (1) symmetrical about two perpendicular planes through its axis and (2) subject to an axial load, N, combined with bending in one or both of the planes of symmetry (but with the ratio of eccentricity to depth, e/t, no greater than 1.0 in either plane), the combined fiber stress in compression may be computed on the basis of recognized theory applying to uncracked sections, using the following formula.

$$f_c = \frac{N}{A_g}\left[\frac{1 + \frac{De}{t}}{1 + (n - 1)p_g}\right]$$

Equating this calculated stress, f_c, to the allowable stress, f_p, in formula in Section 2713, j, it follows that the column can be designed for an equivalent axial load, P, as given in the following formula.

$$P = N \left[1 + \frac{CDe}{t} \right]$$

When bending exists on both axes of symmetry, the quantity $\frac{De}{t}$ is to be computed as the numerical sum of the $\frac{De}{t}$ quantities in the two directions.

2. For columns in which the load, N, has an eccentricity, c, greater than the column depth, t, or for beams subject to small axial loads, the determination of the fiber stress f_c shall be made by the use of recognized theory for cracked sections, based on the assumption that no tension exists in the concrete. For such cases the tensile steel stress shall also be investigated.

j. Allowable Combined Axial and Bending Stresses. For spiral and tied columns, eccentrically loaded or otherwise subjected to combined axial compression and flexural stress, the maximum allowable compressive stress, f_p, is given by the following formula.

$$f_p = f_a \left[\frac{1 + \frac{De}{t}}{1 + \frac{CDe}{t}} \right]$$

$$= f_a \left[\frac{t + De}{t + CDe} \right]$$

Wherein the notation is that of Section 2713, c, and 2713, i, and, in addition f_a is the average allowable stress on an axially loaded reinforced concrete column, and C is the ratio of f_a to the allowable fiber stress for members in flexure. Thus $f_a = \frac{0.225\, f'_c + f_s p_g}{1 + (n-1)\ p}$ for spiral columns and 0.8 of this value for tied columns, and

$$C = \frac{f_a}{0.45\ f'_c}$$

k. Monolithical Walls. 1. Plain concrete walls shall have at least the thickness specified in Part XXVIII. Reinforced concrete walls shall be reinforced in two directions at right angles by steel reinforcement having an effective area in each direction of not less than (0.0025) times the cross-sectional area of the concrete. In walls ten inches or more in thickness, not less than half the steel required by this paragraph shall be placed as close to each face of the wall as requirements for fire and rust protection will allow. Such steel reinforcement shall be in the form of reinforcing bars not less than three-eighths inch in diameter and spaced not over eighteen inches apart or of approved wire mesh.

2. The capacity of a reinforced concrete wall to support a vertical load shall be computed in the same manner as specified in Sections 2713, d; 2713, g; and 2713, h with lateral ties. The vertical reinforcement shall not be assumed to contribute to the capacity of the wall unless it conforms to the requirements for longitudinal reinforcement in columns and is stayed by lateral ties perpendicular to the wall.

3. Non-bearing retaining walls may be designed as slabs.

Sec. 2714. Concrete footings.

a. Sloped or Stepped Concrete Footings. 1. Footings may have sloped or stepped tops provided that the thickness of the footing above the reinforcement shall not be less than six inches for footings on soil, nor less than nine inches for footings on piles.

2. Concrete in reinforced footings shall be proportioned for a strength of at least two thousand pounds per square inch.

b. Bending in Concrete Footings. 1. The critical section for bending in a concrete footing which supports a concrete column or pedestal, shall be considered to be at the face of the column or pedestal. Where a steel or cast iron column base rests on a footing, moments in the footing shall be considered at the middle and at the edges of the base. The loads shall be considered as uniformly distributed over the column, pedestal or base. In the case of a round or polygonal column or base, its face for the purposes of this section shall be considered to be at the side of a concentric square of equal area.

2. The bending moment at a critical section shall be computed from all the forces acting on the footing on one side of the section (excluding the weight of the footing), and for footings resting upon soil the bending moment may be taken as three quarters of the

moment obtained by assuming the soil pressure to act only vertically and with uniform intensity.

3. Shear in footings shall be computed as specified in section 2710, h.

c. Bearing on Concrete Footings. 1. The unit compressive or bearing stress on top of a pedestal or footing directly under the column or base shall be not greater than that determined by the formula.

$$\frac{f'_c}{16}\left[3 + \frac{A}{A}\right]$$

Nor greater than $(0.375\, f'_c)$, unless the pedestal or footing is reinforced laterally as provided in paragraph (2).

2. When lateral reinforcement in the form of a spiral or hoops is provided in the pedestal or footing the unit stress in bearing for the core area may be increased to $(1 + 2.5\, np')$ times that allowed for plain concrete, but no area outside the outer face of the spiral or hoops shall be considered.

3. The unit compressive stress on the gross area of the pier, pedestal or footing shall not exceed $0.25\, f'_c$.

d. Concrete Pedestal without Reinforcement. 1. The compressive unit stress on the gross area of a concentrically loaded pedestal or pedestal footing shall not exceed $0.25\, f'_c$.

2. The depth of a pedestal footing shall not be greater than three times its least width and the projection on any side from the face of the supported member shall not be greater than one half of the depth for a rectangular footing and fifty-eight one hundredths of the depth for a circular footing. The depth of a pedestal whose sides are sloped or stepped shall not exceed three times the least width or diameter of the section midway between the top and the bottom. A pedestal footing supported directly on piles shall have a mat of reinforcing bars having a cross-sectional area not less than two tenths of a square inch per foot of width in each direction, placed three inches above the top of the piles.

PART XXVIII.

Excavation, Foundations and Piling.

§ 2801. Safeguarding, general.
§ 2802. Support of neighboring structure.
§ 2803. Support of party wall.
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§ 2820. Allowable loads on piles.
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Sec. 2801. Safeguarding, general.

Excavations shall be properly guarded as herein provided against danger to life or limb and so that the adjoining soil, walls, building or structure shall not be damaged in any way.

Sec. 2802. Support of neighboring structure.

a. When excavation is less than ten feet. Whenever an excavation is not carried more than 10 ft. below the curb level opposite the party line, the owner of every nearby wall, buildings or structure shall protect the same, so that they shall be safe, and he shall be permitted to enter upon the premises where such excavation is being made for the purpose if necessary.

b. When excavation is more than ten feet. 1. Whenever an excavation is carried more than 10 ft. below curb level the person causing such excavation to be made, if afforded permission by the nearby owner, shall, at his own expense and under the direction of the Superintendent, preserve every nearby wall, building, or structure from injury, and support the same by proper foundation or retaining walls so that they shall be safe whether said wall, building, or structure is down more or less than 10 ft. below the curb, and for this purpose proper foundations or retaining walls may be built upon the nearby premises.

2. If the necessary permission is not given by the nearby owner, then such nearby owner shall, at his own expense, and under the direction of the Superintendent, make his wall, building, or structure safe, supporting same so that the new excavation can be made, and he shall be permitted to enter upon the premises where such excavation is being made for that purpose if necessary.

c. *Variable curb elevations.* In the event that the elevation of the curb is variable, the mean elevation of all the curbs adjacent to the lot shall be taken as a basis to determine the depth of the proposed excavation.

Sec. 2803. Support of party wall.

1. In case there is a party wall along a lot-line of the premises where an excavation is being made, the person causing the excavation to be made, shall at his own expense, preserve such party-wall in as safe a condition as it was before the excavation was commenced and shall, when necessary, underpin and support the same by proper foundations.

2. No party wall between two estates shall be added to in height or underpinned unless the whole wall when so added to or underpinned conforms to the requirements of this Code, and in so far as said wall is used or intended to be used in common, all additions or underpinning thereto shall be made symmetrically with the center of gravity of the wall, but not to extend beyond the inside line of the existing footing. If the wall is added to by building in columns or a steel or reinforced concrete frame to be used exclusively on one side, proper foundations shall be built for such columns or frame, and the parties making such installation shall have the right to extend such foundations only as far under the adjoining premises as the inside line of the footing of the party wall existed before the addition.

Sec. 2804. Superintendent may act.

If the person whose duty it shall be under the provisions of this part to properly guard and protect an excavation, or to prevent adjoining earth from caving in, or to preserve or protect any wall, building or structure from injury, shall refuse or neglect so to do, the Superintendent may with the approval of the Mayor enter upon the premises and employ such labor, and furnish such materials and take such steps as, in his judgment, may be necessary to prevent adjoining earth from caving in or to make such wall, building or structures safe and secure, or to prevent the same from becoming unsafe or dangerous to life or limb. The costs and charges incurred by this work shall be paid by the person responsible as above mentioned. If such person fails to pay such incurred expense, the City of Cambridge shall bring action against said responsible person to recover the cost of the work performed. These costs and charges incurred shall constitute a lien upon the land and/or buildings and shall be enforced within the time and in the manner provided for the collection of taxes on land.

Sec. 2805. Filled grounds and excavation below footings.

1. No building shall be constructed with footings supported directly on filled ground unless such ground is proved satisfactory to the Superintendent by tests.

2. Underground piping and conduits, and foundations other than the piers and walls of the building, shall be so laid out and planned that excavation will not be required below any part of the footings of the building and will not require said footings to be built on earth which has been moved, replaced, or disturbed in any way.

Sec. 2806. Borings and tests.

When doubt arises as to the safe sustaining power of soil upon which a building is to be erected, the Superintendent may order boring to be made or he may order tests of the sustaining power of the soil at the expense of the owner of the proposed building. The Superintendent shall be notified before any test is made, shall be present or represented thereat, and shall decide upon the allowable load to be used, and record of such borings or tests shall be filed in the office of the Superintendent of Buildings.

Sec. 2807. Bearing capacity of soil.

In the absence of an actual test of the sustaining power of the soil to the satisfaction of the Superintendent the area of the footing shall be proportioned so that the load per sq. ft. upon the respective characters of soil shall not exceed those in the following table.

TABLE 2807A

Soft clay	1 ton	Coarse sand	4 tons
Wet sand	2 tons	Gravel	6 tons
Hard clay	6 tons	Soft rock	8 tons
Sand and clay: Mixed or in layers	2 tons	Hardpan	10 tons
Fine dry sand compact	3 tons	Medium rock	15 tons
		Hard rock	40 tons

Sec. 2808. Foundation loads.

a. Loads. The loads to be used in computing the maximum pressure upon bearing materials under foundations shall be the live and dead loads of the structure, as specified in Section 2303, including the weight of the foundations, but excluding loads from overlying soil.

b. Eccentric Loading. Eccentricity of loading in foundations shall be fully investigated and the maximum pressure shall not exceed the allowable bearing values.

c. Wind Loads. Where the pressure on the bearing material due to wind is less than twenty-five per cent of that due to dead and live loads, it may be neglected in design. Where this ratio exceeds twenty-five per cent, foundations shall be so proportioned that the pressure due to combined dead, live and wind loads shall not exceed the allowable bearing values by more than twenty-five per cent.

Sec. 2809. Footings partly on rock and other materials.

Footings resting partly on rock and other unyielding material and partly on yielding soil shall be proportioned so that the stress on the yielding soil will not cause serious unequal settlement of the structure.

Sec. 2810. Foundation materials and depth.

All foundations for buildings of type 1, 2, 3, and 4 construction, of all buildings of type 5 and 6 construction having a cellar or basement, or more than one story high, or greater than 300 sq. ft. in area shall be of masonry, and shall extend 4 ft. below any adjoining surface exposed to frost unless they rest on bed rock, and they shall reach through loam or fill to undisturbed natural earth, or shall rest on piles. All trenches shall be kept reasonably free from water when laying foundations, and no foundation shall be started on frozen ground.

Sec. 2811. Dampproof and waterproofing cellars.

Basements or cellars which are surrounded by water-bearing soil shall be waterproofed up to a grade at least 2 ft. above the maximum probable ground water level. Walls and floors to be so waterproofed shall be designed to resist full hydrostatic pressure. Under boilers, furnaces, and other heat producing apparatus, suitable insulation shall be installed to protect the waterproofing against damage from heat.

Sec. 2812. Thickness of foundation walls.

a. General. The thickness of foundation walls shall, in all cases, irrespective of any other requirements of this section, be sufficient to keep the stresses in the masonry and on the soil within the working stresses prescribed by this Code.

b. Buildings of Type 5 and 6 Construction. 1. Cellar or trench walls above grade not more than 6 ft. high shall have the following minimum thickness in inches: if more than 6 ft. high the wall shall be increased by 4 in. for every 6 ft. or fraction thereof.

Concrete, solid, or concrete blocks	8
Brick	8
Block stone, one course high	8
Block stone, more than one course high	12
Rubble	16

2. Foundations below grade shall have the following minimum dimensions in inches:

	Wall Thickness	Footing Width Except on Ledge
Concrete, solid	10	16
Brick, concrete block	12	16
Block stone	16	20
Rubble	20	20

3. Provided, however, that walls retaining more than 6 ft. and less than 10 ft. of earth shall have the following minimum dimension in inches: if more than 10 ft. the wall shall be increased by 4 in. for every 10 ft. or fraction thereof.

	Wall Thickness	Footing Width Except on Ledge
Concrete, solid	12	20
Brick	16	20
Block stone	16	24
Rubble	24	24

c. Buildings Other than Type 5 and 6 Construction. 1. Foundations for masonry buildings, retaining not more than 10 ft. of earth shall be at least 4 in. thicker than the first story wall, but not less than the following dimensions in inches in any case:

	Wall Thickness	Footing Width Except on Ledge
Concrete, solid	12	24
Brick	16	24
Block stone	16	24
Rubble	24	24

2. Each additional 10 ft. in depth shall be 4 in. thicker than the section above and the footing shall be widened 4 in.

Sec. 2813. Foundation walls, general.

1. Battered walls may be built, provided they give the same cross-sectional area and footing width as required above.

2. The Superintendent may allow reduction in the required thicknesses if the walls are of properly reinforced concrete, or are properly strengthened by steel columns or beams, or are held laterally by intermediate floors.

3. Isolated piers may be used instead of continuous foundations if the character of soil, building, or structure makes it necessary or advisable and the Superintendent approves.

4. Rubble foundation walls shall not be used for buildings over 2½ stories high. When rubble foundations are used under masonry buildings, the lowest course, if of stone, shall be good flat stones full width of footing, well bedded in mortar upon the ground.

5. Concrete foundation walls and footings shall be laid in forms securely held in position.

Sec. 2814. Plain concrete foundation.

Concrete foundations shall be not poorer than 1 part Portland cement to 7½ parts of aggregate, and shall be mixed, poured, and cured in accordance with Part XXVII.

Sec. 2815. Reinforced concrete foundation.

Reinforced concrete foundations shall conform to requirements of Part XXVII, but the concrete shall not be poorer than 1 part Portland cement and 6 parts aggregate. There shall be not less than 3 in. of concrete below reinforcement or between reinforcement and the top of piles unless protected by waterproofing satisfactory to the Superintendent.

Sec. 2816. Steel grillage foundations.

Steel grillage foundations shall conform to Part XXVII and shall have at least 6 in. of concrete below, and shall be entirely embedded in and surrounded by concrete at least 4 in. thick between steel and earth, and the concrete shall not be poorer than 1 part Portland cement and 6 parts aggregate.

Sec. 2817. Footings.

a. General. No foundation wall or footing shall be laid without previously notifying the Superintendent at least 24 hours in advance of the time footing is ready to build. The Superintendent may change this procedure if he deems it advisable.

b. Brick. Brick footings shall project not more than 1½ in. per course and there shall be a double course at bottom, projecting not more than 3 in.

c. Concrete. Concrete footings shall conform to the provisions set forth under Section 2714.

Sec. 2818. Mortar for foundation walls.

Mortar for all foundations for buildings, and structures and for retaining walls shall be Portland cement mortar. Portland cement mortar shall be made of 1 part Portland cement and not more than 3 parts of sand by volume. Lime putty or hydrated lime may be added to an amount equal to 15% of the volume of the cement.

Sec. 2819. Piles.

a. General. All buildings shall, if the Superintendent determines that piling is necessary, be constructed on foundation piles, and the number, diameter and bearing of such piles shall be sufficient to support the superstructure proposed. The Superintendent shall determine the grade at which the piles shall be cut. He may require any applicant for a permit to ascertain by boring the nature of the ground on which it is proposed to build, and he may require a competent inspector satisfactory to him to be on the work at all times while piles are being driven, which inspector shall keep an accurate record of the length of each pile, the weight and fall of the hammer, and the penetration of each pile for each of the last two blows of the hammer.

b. Pile Spacing. The minimum distance in the clear between piles shall be not less than 12 in., except that the Superintendent may allow the piles in any one row to be closer together if, in his judgment, it is proper, but the piles adjacent to such closely spaced row shall not be less than 12 in. apart in the clear. Detached column or pier footings shall have at least 3 piles each, but column or pier footings connected by proper masonry foundations or steel construction to provide adequate lateral support in both directions may be supported by one pile if the load does not exceed that allowed by this Code. Light wall foundations may be supported on a single row of piles, provided the length unsupported laterally by proper masonry foundations or steel construction does not exceed 10 ft. All other foundations shall be supported on at least two rows of piles, the rows to be at least 10 in. c. to c.

c. Wood Piles. Every wooden pile shall be in one piece, cut from a sound live tree, and free from defects which may materially impair its strength or durability. It shall be butt-cut above the ground swell, and shall have substantially uniform taper from butt to tip. Wooden piles shall measure at least six inches in smallest diameter at the tip, at least eleven inches in smallest diameter two feet from the butt and at least ten inches in smallest diameter at the cut-off, these measurements being taken under the bark. The axis of a wooden pile shall not deviate from a straight line more than one inch for each ten feet of length nor more than six inches. Square timber of approved quality may be used as piling, in which case the average cross-section shall be not less than the commercial ten by ten inch section.

d. Precast Concrete Piles. Concrete piles moulded and cured before driving shall not be provided with more than 4% of longitudinal reinforcement. The diameter or lateral dimension of such a pile shall be not less than 8 inches at the foot and shall not average less than 12 inches in the length of the pile. The length shall not exceed twenty times the average diameter in any case.

e. Cast-in-Place Concrete Piles. Concrete piles cast in place shall be so made and placed as to insure the exclusion of any foreign matter, and to secure a perfect full-sized shaft. The average diameter of any such pile in place shall be not less than 11 inches and the diameter of the foot shall be not less than 6 inches. The length shall not exceed thirty times the average diameter. The allowable load shall not exceed 350 pounds per sq. in. on concrete. The placing of concrete through water in such piles is prohibited.

f. Steel Piles. Rolled structural steel piles and steel pipe piles will also be permitted provided the design conforms with the requirements of this Code and is approved by the Superintendent of Buildings. However, the load on rolled steel piles shall not exceed 8500 lbs. per sq. in. and the maximum load on steel pipe piles shall not exceed 5000 lbs. per sq. in. on the concrete and 7500 lbs. per sq. in. on the steel.

Sec. 2820. Allowable loads on piles.

a. Wood Piles. 1. Wooden piles driven to refusal through loose fill or wet soil, incapable of adequately resisting lateral bonding, shall be figured as columns with an area equal to the middle cross-section. The safe load on all other wooden piles driven by drop hammer shall not exceed 12 tons for spruce or Norway pine or 15 tons for yellow pine or oak, and shall be determined by the following formula:

$$L = \frac{2\ WH}{P + 1}$$

2. If driven by single-acting power hammer the safe sustaining power shall be determined by the following formula:

$$L = \frac{2\ WH}{P + 0.1}$$

In both formulas:

W is the weight of the hammer in lbs.
L is the allowable load in lbs.
H is the fall of the hammer in ft.
P is the average penetration in inches under the last three blows after the pile has been driven to a point where successive blows produce approximately equal penetrations.

b. Concrete Piles. Concrete piles driven to refusal through loose fill or wet soil, incapable of adequately resisting lateral bending, shall be allowed a load not exceeding 400 lbs. per sq. in. of the middle cross-section, plus 6,000 lbs. per sq. in. of the steel reinforcement. The safe load for other piles shall be determined by the formulas given in Section 2820, a, determined by striking the pile without cushion cap.

Sec. 2821. Pile caps.

1. Piles under masonry buildings shall be capped with concrete or with block granite. If capped with concrete, the proportions shall be 1 part Portland cement to not more than 6 parts aggregate. If capped with block granite, each block shall have a firm bearing on not more than 3 piles and shall be not less than 12 in. thick and shall project enough to fully cover the pile caps.

2. Piles under steel or wooden frame buildings without masonry walls may be capped with timber not less than 6 in. thick and securely joined together, in which case the piles shall be cut off below the static water level.

Sec. 2822. Concrete for concrete piles.

The concrete for concrete piles shall be mixed in the proportion of 1 part Portland cement to not more than two parts clean coarse sand, and four parts broken stone or gravel of a size passing through a one-inch ring, with only sufficient water to produce a plastic consistency. The concrete as it is placed must be spaded or otherwise agitated to insure uniform consistency and a complete filling of the pipe or mould. The placing of the concrete of a pile, when once started, must continue uninterruptedly till the pipe or mould is entirely filled.

Sec. 2823. Test piles.

The Superintendent may require test piles to be loaded and may fix allowable loads based upon such tests, but he shall not allow a greater load than one half of the test load giving ¼ in. settlement. Such tests shall be under the supervision of the Superintendent and the results shall be filed in his office, but shall be at the expense of the owner.

PART XXIX.

Courts and Vent Shafts.

§ 2901. Conformity.
§ 2902. Unobstructed.
§ 2903. Drainage.
§ 2904. General.
§ 2905. Size of courts.
§ 2906. Construction.
§ 2907. Air intake.
§ 2908. Accessibility.
§ 2909. Courts on right of way.
§ 2910. Vent shafts in buildings other than dwellings.

Sec. 2901. Conformity.

Where inner and outer courts and vent shafts are provided in the design of a building, they shall conform with the provisions of this Part. No court shall be deemed to satisfy the requirements of more than one building.

Sec. 2902. Unobstructed.

1. Courts shall be at every point open to the sky and unobstructed by buildings or parts thereof, except for the following projections.

2. Cornices, balconies, belt courses, window and door sills projecting not more than 1/10th of the actual width of the court measured to the opposite wall of a court or to the lot line if the side yard is a part of the required width of an outer court.

3. Open iron fire escapes permitted or required by this Code.

4. First story steps, platforms and porches when no contiguous portions of the basement are occupied for habitation.

Sec. 2903. Drainage.

The bottom of every court or vent shaft open at the top, shall be properly graded and drained, and when required by the Superintendent, in the interest of public health, shall be paved with concrete or other suitable materials and shall connect with a sewer as provided in Section 3913, b, of this Code.

Sec. 2904. General.

1. Courts may begin at any level. Where courts are irregular

in shape, their dimensions shall be such as to provide, in the opinion of the Superintendent, a court equivalent in effect to a rectangular court as herein prescribed.

2. Extension of courts at an angle with the longest horizontal direction of the court, or offsets or recesses in courts may be built; provided, however, that the length of any such extension, offset, or recess shall not be greater than its width. There shall be no further extension to an offset or recess opening from any such extension, offset, or recess. In computing the area of courts the additional area offered by offsets, or recesses shall not be included.

3. Walls may be built across the inner angles of courts but the resulting unobstructed area of the court must not be less than the minimum area required.

Sec. 2905. Size of courts.

Every court shall have a width, at any given level, of not less than one-third of the height of such court, but not less than 6 ft. The cross-sectional area of a court shall be not less than 1½ times the square of its width, but in no case shall the courts be less than the following minimum sizes:

Height of Court in Habitable Stories	Width in ft.	Area in sq. ft.
1	6	54
2	6	54
3	9	121
4	12	216
5	15	338
6	18	482
7	21	661
8	24	864
9	27	1093
10	30	1350

Sec. 2906. Construction.

a. General. 1. The walls of outer and inner courts shall be constructed of the same material and of the same thickness required for the exterior walls of the building.

2. When there are one or more stories under a court, the floor of the court shall be of concrete or other incombustible material, of a 4 hour fire-resistive construction, as specified in Part XXXVII.

b. Outer Courts. All door and window openings in outer court walls shall conform to the provisions of section "Exterior Walls" in Parts VI to XVI inclusive.

c. Inner Courts. All door and window openings in inner courts shall be equipped with Class B fire doors and fire windows.

Sec. 2907. Air intake.

1. Every inner court shall have at least one air intake. One intake shall communicate directly with the street or yard.

2. An air intake is a passageway enclosed with walls, floors and ceilings having a fire-resistive rating of not less than 2 hrs. in buildings of Type 1 or Type 2 construction and not less than 1 hr. in buildings of Type 3 or Type 4 construction. Such air intake shall not be less than 4 ft. sq. for vent shafts and not less than 3 ft. wide by 7 ft. high for courts, connecting the bottom of a vent shaft or court with a street or yard to permit circulation of air and, when serving courts, closed only by open grille doors containing not less than 15 sq. ft. of unobstructed area.

Sec. 2908. Accessibility.

Every court that is not otherwise accessible at the bottom, shall be made accessible by a door or other means to enable it to be properly cleaned.

Sec. 2909. Courts on right of way.

1. For the purpose of this section a public or private right of way shall be deemed a court to the center line of such right of way. In case the width is less than required for a court, the building or that part dependent thereon shall be set back sufficiently to provide the required width, considering one-half of the right of way as a part of the court.

2. Door and window openings in the walls of such courts shall conform to the provisions of section "Exterior Walls" in Parts VI to XVI inclusive.

Sec. 2910. Vent shafts in buildings other than dwellings.

(For vent shafts in dwellings, see Part XIII.)

a. General. Where vent shafts are provided in a building, to light and ventilate a stairway in other than dwellings, they shall conform with the following provisions.

b. Skylights. Unless open to the outer air at the top, for its full area, such a shaft shall be covered with a metal skylight that has a net area of fixed louvre openings equal to the required shaft area.

c. Construction. The walls of a vent shaft, when open at the top, shall be constructed of the same material and of the same thickness required for the exterior walls of the building. If the shaft is closed at the top, the walls shall be constructed in accordance with the requirements of Part XXX.

d. Area. The area of vent shafts shall be as follows:

Height of Shaft in Stories	Ft. in Width	Area in sq. ft.
1	3	15
2	3	15
3	3	15
4	4	25
5	5	35
6	6	45
7	7	55
8	8	65
9	9	81
10	10	100

PART XXX.

Enclosure of Stairs and Vent Shafts.

§ 3001. General.
§ 3002. Enclosure walls.
§ 3003. Openings.
§ 3004. Required enclosures.
§ 3005. Vent shafts and chutes.

Sec. 3001. General.

Where stairs and vent shafts are required to be enclosed, the enclosing walls shall extend to the under side of the roof boarding, slab or arch.

Sec. 3002. Enclosure walls.

a. Buildings of Type 1, 2, 3 and 4 Construction. The enclosure walls of stairs and vent shafts shall be of 2 hour fire-resistive construction as described in Part XXXVII.

b. Buildings of Type 5 and 6 Construction. The enclosure walls of stairs and vent shafts shall be of 1 hour fire-resistive construction as described in Part XXXVII.

Sec. 3003. Openings.

a. In Stairways. All doorways leading into stairways required to be enclosed shall be provided with class B self-closing fire doors, as described in Part XXXVII. Windows in interior enclosure walls shall be approved fixed fire windows.

b. Vent Shafts. Openings in vent shafts and shaftways other than stairways shall be protected with approved fire doors or fire windows which are to be self closing or automatic when required by the Superintendent.

Sec. 3004. Required enclosures.

a. General. Stairs and other shaftways, in addition to any requirements of the Department of Public Safety, shall be enclosed with the constructions required in Section 3002 in the following manner.

b. For Stairways in Dwellings. Stairways in dwellings, under group H and group I occupancy shall be enclosed as specified in Part XIII.

c. Other Buildings. 1. Hospitals, asylums, nurseries, and detention buildings to have all stairways enclosed.

2. Libraries, museums, court houses, city halls, fire or police stations, 3 stories or more high, to have at least one stairway enclosed.

3. Buildings having an assembly hall or lodge room, churches, amusement halls, and exhibition buildings to have all basement stairs closed, and, if such rooms are in the third story or above, shall have the stairway enclosed.

4. For schoolhouses, college classroom buildings, theatres, moving picture houses, opera houses, and music halls, see Department of Public Safety regulations.

5. Office buildings, if 4 or 5 stories high, shall have at least one stairway enclosed. If 6 or more stories high shall have all stairways enclosed: provided, however, that they need not be enclosed in first story if opening into a public lobby leading direct to exit and separated from rest of building by first-class construction; and provided, further, that independent flights connecting not more than 2 stories need not be enclosed.

6. Buildings more than 3 stories high and used above the first floor for the storage or sale of merchandise or for restaurant purposes shall have all stairways enclosed except independent flights connecting not more than 2 stories.

7. Manufacturing buildings over 2 stories high shall have all stairways enclosed.

8. Stables, 3 or more stories high, shall have all stairways enclosed except runway for horses from first and second floors.

9. (For garages, see Department of Public Safety regulations.)

10. Amusement parks, armories, baseball parks, car barns, foundries, grand stands, green houses, ice houses, light and power plants, mill and other buildings constructed for special industries, and other buildings as classified in this Code shall have stairways enclosed when required by the Superintendent.

Sec. 3005. Vent shafts and chutes.

Vent shafts and other vertical shaftways or chutes of more than 4 sq. ft. area shall be enclosed as required in Sections 3002 and 3003 if they extend through more than one story. Shaftways or chutes of 4 sq. ft. or less in area shall be made of, or lined with, incombustible materials if they extend through more than one floor.

PART XXXI.

Projections over Public Ways.

§ 3101. General.
§ 3102. Maximum projections.
§ 3103. Permits revocable.
§ 3104. Alterations.
§ 3105. Existing encroachments.

Sec. 3101. General.

1. Except as hereinafter provided in this Part, no portion of a building hereafter erected or of an enlargement of a building heretofore erected shall project beyond a street line, a square or other public way.

2. Such projections as are permitted under this Part shall be constructed of materials that conform to the provisions of sections "Projections from Buildings" under Parts XVI to XXII inclusive.

3. Projections over public ways shall also conform to the provisions of the City ordinance, but in no case shall the projections be greater than permitted in this Part.

Sec. 3102. Maximum projections.

a. Cornices, Balconies, Bay Windows. Cornices, balconies and bay windows may project a distance equal to 1/20 of the width of the public way; provided, however, that in no case shall they in any part so project more than 3 feet, nor less than 10 ft. above the curb level.

b. Spacing of Bay Windows. No bay window projecting over a public way shall be more than 15 feet long and no two such bays in any story shall be less than 5 feet apart.

c. Window Sills, Belt Courses, etc. Mouldings, belt courses, sills, architraves, pediments, pilasters and similar projections may project 1/4 of the projection allowed for cornices of the wall on which they occur but in no case shall they be more than 4 inches when they are less than 10 feet above the curb level.

d. Doors. No door shall be hung hereafter so as to project, when fully open, more than 6 inches over a public way.

e. Marquees. Marquees at entrances to buildings may extend beyond the street-line and across the sidewalk to the curb line; provided they are not less than 10 feet above the curb-level at all points.

f. Signs. The projection of signs over public ways shall conform to the provisions in Part XXXVI.

g. Rain Water Leaders—Conductors. Rain water leaders and conductors shall not project more than 6 inches.

h. Fire Escapes. Fire escapes when required by order of the Massachusetts Department of Public Safety and permitted by this Code and constructed of incombustible materials may project not more than 4 feet and in no case shall they exceed ½ the width of a right of way; provided that nothing in this Part shall prevent the use of cantilever stairs to the sidewalk, so arranged that they are 10 feet or more above the sidewalk when not in actual use.

i. Set Back on Buildings. When a building is set back to allow increased height, the line of set back required for the increased height shall be considered the street line beyond which projections shall be allowed on the portions of the building that are so set back.

j. Exterior Hose Connections. Exterior hose connections for fire extinguishing equipments or fresh air inlets for plumbing systems, hereafter installed, shall be set inside the legal building-line; or in recesses in the street walls when such walls are on the building-line; or they may be placed in the angle made by the street wall with a pilaster or other permissible projection outside the building-line.

Sec. 3103. Permits revocable.

Permission, expressed or implied in the provisions of this Part, to construct a building or portion thereof so as to project beyond the street-line or building-line is revocable by the municipality at will.

Sec. 3104. Alterations.

No change or enlargement shall be made to an existing part of a building now projecting beyond the street-line or building-line, except in conformity with the provisions of the Part for new construction.

Sec. 3105. Existing encroachments.

Parts of buildings which already project beyond the street line or building-line may be maintained as constructed until their removal is directed by the municipality.

PART XXXII.

Roofs and Roof Structures.

§ 3201. Roof dainage.
§ 3202. Access to roof.
§ 3203. Roof structures.
§ 3204. Dormers.
§ 3205. Tanks.
§ 3206. Skylights.
§ 3207. Use of roof.

Sec. 3201. Roof drainage.

All parts of roofs shall be sloped to drain at a pitch of not less than 1 in. in 10 ft. Gutters and conductors shall be provided and the rain water shall be disposed of in a manner satisfactory to the Superintendent but in no case shall water, ice or snow be discharged upon a public way of adjoining property.

Sec. 3202. Access to roof.

Every building over one story high and having a flat roof shall have permanent access to the roof, from the inside of the building through an opening at least 2 ft. x 3 ft. with fixed step ladder or stairs. Such opening shall have direct access from a public corridor or stair hall and shall not be equipped with a key lock.

Sec. 3203. Roof structures.

a. Height of Buildings and Structures. 1. The limitation upon the height of buildings measured to the highest point of the roof, specified in Parts VI to XV inclusive, shall not be held to limit the height of the steeples of churches, towers, domes, cupolas, belfries, parapets, cornices, statuary, balustrades, railings, flag poles, weather-vanes, chimneys, vent pipes, skylights, ventilators, steam exhausts, tanks, roof structures, for the enclosure of tanks, stairways, elevator machinery, ventilating fans and the like, erected upon or above the roof of a building, provided such structures shall not be occupied by persons nor be used for storage or for a manufacturing process.

2. Roof structures enclosing elevator machinery, ventilating fans, tanks, elevators, stairways and the like shall not be larger than reasonably necessary for their purpose, including the storage of

tools, spare parts, appliances and materials necessary for the maintenance and repair of such equipment.

b. Construction. 1. The walls of roof structures, erected on buildings of Type 1 construction, shall be of masonry and shall have a fire-resistive rating of at least 2 hours. The roof shall be of the same construction as the roof of the building on which they rest. The roof covering shall be of incombustible material.

2. The walls and roofs of roof structures, on buildings of other types of construction, shall be covered with sheet metal or other approved incombustible material.

3. The wall of a roof structure which rests upon the exterior wall of a building shall be of the same construction as the exterior wall of the building.

4. Doors and frames, scuttles and frames, and windows in roof structures shall be covered with incombustible material.

Sec. 3204. Dormers.

The roof of dormers shall be covered with any incombustible material.

Sec. 3205. Tanks.

1. Tanks of more than 1,000 gallons capacity hereafter placed on a building shall be supported on masonry, reinforced-concrete or steel construction.

2. Such tanks shall not be placed over nor near a line of stairs or an elevator shaft, unless there is a solid roof or floor underneath the tank.

3. All tanks of over 1,000 gallons capacity shall be of incombustible material.

Sec. 3206. Skylights.

1. Except on greenhouses, and except over photographic studios with the approval of the Superintendent, skylights shall be glazed with wire glass or shall be protected by wire screens. Such screens shall be of at least No. 12 gage wire with not larger than one-inch mesh, on substantial metal supports, at least six inches but not more than twelve inches above the glass and parallel thereto, and projecting at least six inches beyond the edge of the skylight.

2. Skylights over stairways and corridors, and skylights over

restaurants, halls and other public rooms, shall be glazed with wire glass or protected by a wire screen or a ceiling light of wire glass below.

3. Skylights shall be designed to support the live loads specified in Part XXIII for roofs of corresponding slope.

4. The parts of skylights exposed to the weather, gutters for leakage or condensation, outside screens and their supports of metal, shall be on non-corrodible metal, except that skylights over greenhouses may be of wood.

Sec. 3207. Use of roof.

a. For Assembly. It shall be unlawful to use or permit the use of the roof of a building or structure as a place of assembly, unless it has been designed for that purpose and provided with adequate exits.

b. For Household Purposes. No roof of a building shall be used for hanging out clothes or for drying wash, or for other household purposes unless there shall be provided substantial guard rails, fences, parapets or other safeguard along the edges of such roof or that part of it which is restricted to the uses herein specified.

PART XXXIII.

Stairs, Exits and Corridors.

§ 3301. State regulations.
§ 3302. Regulations on residence buildings.
§ 3303. Application.
§ 3304. Number of occupants.
§ 3305. Number of exits.
§ 3306. Access to roof.
§ 3307. Location of exits.
§ 3308. Lighting of exits.
§ 3309. Interior stairways.
§ 3310. Horizontal exits.
§ 3311. Corridors.
§ 3312. Iron fire escapes.
§ 3313. Outside doors.
§ 3314. Radiators.

Sec. 3301. State regulations.

The laws, rules and regulations of the Massachusetts Department of Public Safety with respect to the means of egress of buildings shall not be deemed to be modified by any provisions of this Part; and such restrictions shall be controlling, except insofar as this Part imposes greater restrictions, in which case the provisions of this Part shall control.

Sec. 3302. Regulations on residence buildings.

For regulations on stairs, exits and corridors in two family and multi-family buildings refer to Parts XIII and XIV.

Sec. 3303. Application.

a. New Buildings. Buildings hereafter erected shall be provided with exit facilities in accordance with the requirements of this Part.

b. Alterations. No building shall hereafter be altered so as to reduce the number or capacity of exits to less than required for buildings of similar construction and occupancy hereafter erected. Exits hereafter installed shall conform to the requirements for exits in new buildings except when such exits are installed to comply with a specific order of the Superintendent.

c. Existing Buildings. Every existing building which is not provided with exit facilities as prescribed in this Part for new buildings and in which the exit facilities are inadequate for the safety of the occupants, shall be provided with such means of egress as shall be directed in a written order by the Superintendent.

Sec. 3304. Number of occupants.

When the number of persons to be accommodated by the exits is not stated in the application for a permit, or is not otherwise fixed, it shall be decided on the basis of the area devoted to a particular purpose, and shall be assumed to be one person for every 6 sq. ft. in dance halls, lodge rooms and places of assembly; one person for every 15 sq. ft. in court rooms, restaurants, classrooms in schools and colleges, and rooms in public-buildings not otherwise provided; one person for every 25 sq. ft. in stores, markets, lodging houses and reading rooms; one person for every 35 sq. ft. in factories and workrooms; one person for every 50 sq. ft. in offices and showrooms; one person for every 100 sq. ft. in hospitals, asylums, hotels, lodging houses, and other residential buildings; and one person for every 150 sq. ft. in warehouses and garages. For occupancies not herein specified, the Superintendent shall establish the ratio to be assumed.

Sec. 3305. Number of exits.

a. Door Exits. Doors serving more than 50 persons and opening to public corridors or to enclosed stairs shall open toward the line of travel. Rooms accommodating more than 50 persons shall have at least two doors leading to exits, each door to be not less than 3 ft. wide, and with an aggregate width of 20 in. for each 100 persons and fraction thereof accommodated. Any fastenings on doors required by this section shall be such as may be easily opened from the inside without the use of keys: provided, however, that this requirement shall not apply to the doors of rooms where persons are held under legal restraint.

b. Exit from Story. Every story of a building shall have at least two separate and independent exits, placed as far apart as possible, and leading directly or indirectly to a street or other area of safety.

c. Places of Assembly. Buildings or portions of buildings used as a place of assembly shall be provided with the number and size of exits required by the Massachusetts Department of Public Safety.

d. Smoke Proof Tower. 1. When the total occupancy of a building above the second floor is more than 500 persons, one of the exits shall be an approved smoke proof tower with access at each floor by means of outside balcony or open air vestibule.

2. Smoke proof towers shall conform to the requirements of this section for interior stairways. The enclosing walls shall be of brick or reinforced concrete not less than eight inches thick. There shall be no openings in such walls, except for the necessary doors or windows. Access to the stairway at each story served by a smoke proof tower shall be by vestibules or outside balconies having solid floors of incombustible materials and provided with substantial railings.

Sec. 3306. Access to roof.

Buildings more than one story high and of flat roof construction, shall be provided with access to roof by means of a stair, fixed ladder or other means approved by Superintendent.

Sec. 3307. Location of exits.

Exits shall be so located that no point in a floor-area, room or space served by them is more than 125 feet distant from an exit, measured along the line of travel; except that when a floor-area is subdivided into smaller areas, such as rooms in hotels and office buildings, the distance from the door of any room, along an unobstructed hallway, to an exit, shall be not more than 100 ft.

Sec. 3308. Lighting of exits.

1. In every tenement house where the public halls and stairs are not, in the opinion of the Superintendent of Public Buildings, sufficiently lighted, the owner of the house shall keep a proper light burning continuously in the hallway, near the stairs, upon each floor, as may be necessary, from sunset to sunrise.

2. In every tenement house occupied by more than three families a proper light shall be kept burning by the owner in the public hallways, near the stairs, upon the entrance floor, and upon the second floor above the entrance floor of the house, every night from sunset to sunrise throughout the year, and upon all other floors of said house from sunset until ten o'clock in the evening.

Sec. 3309. Interior stairways.

a. Construction. All stairs in buildings required to be of Type 1 construction and all stairways required to be enclosed in buildings of Types 2, 3, and 4 construction shall have all stairs, stair landings, and floors, inside the enclosure, of metal or masonry except that hand rails may be of wood. All stairs shall be framed for live loads required in Part XXIII. Required stairs shall have not more than 15 nor less than 6 risers between landings; landings shall be not less than 3 ft. 6 in. wide between risers; the risers shall not exceed 8 in. in height, and the treads shall not be less than 9 in. wide, exclusive of nosings. Required stairs shall have no winders but the Superintendent may allow curved runs of large radius. No closet shall be built under any stairway of wooden construction except in one or two family dwellings.

b. Enclosure. Stairway enclosures shall conform with the provisions of Part XXX.

c. Width. 1. Required stairways except in dwellings and except when serving less than 150 persons, shall be at least 3 ft. 8 in. wide between faces of walls, or 3 ft. 4 in. wide between face of walls and face of balustrade or between faces of two balustrades. If posts project above tops of rails, the required width shall be maintained between the face of the post and the face of the wall or post opposite.

2. For stores and restaurants, the minimum width of the stairs leading down from each story above the first shall be 20 in. in width for each 100 persons or fractions thereof served by such stairway and the minimum width shall be 3′ 6″.

Sec. 3310. Horizontal exits.

A horizontal exit leading to another floor area beyond a fire wall or party wall shall be considered equivalent to one of the required exits for such a floor if such an exit be through an opening constructed as required in Section 505,2, or by an approved outside balcony, and provided that such other ·floor area shall be large enough to contain the joint occupancy, allowing 4 sq. ft. per person.

Sec. 3311. Corridors.

Public exit corridors shall be not less than 3 ft. 8 in. wide and any corridor serving as an exit for more than 200 persons shall have a width of 20 in. for each 100 persons and fraction thereof so served. Two stairways connected by a corridor shall have a width not less than the wider stair.

Sec. 3312. Iron fire escapes.

1. An outside fire escape of approved construction may be considered equivalent to one of the required exits for all buildings not more than 4 stories high. A fire escape may project over a public way, as provided under Section 3102, h.

2. Such fire escapes shall be so located that safe egress will be provided as required by the Superintendent.

3. The construction of fire escapes shall conform to the requirements of the Massachusetts Department of Public Safety.

Sec. 3313. Outside doors.

a. Egress Doors. Required egress doors for buildings accommodating more than 100 persons, except one-story stores of less than 2000 sq. ft. area, shall be arranged to open outwardly.

b. Revolving Doors. 1. Revolving doors shall not be used as exit doors in public-buildings or institutional-buildings, nor shall they be used as exit doors in buildings occupied as stores where more than seventy-five persons are likely to be congregated, unless there are also exit doors of the swinging type, having an aggregate width of at least fifty per cent of required width of exit doors and there is at least one swinging door adjacent to each revolving door.

2. Revolving doors, to be acceptable as exit doors, shall have a width equal to that required for an acceptable swinging door, the width in the case of such a door with rigid braces being the width of a single wing, and in the case of such a door in which the wings may be released from one another by pressure so they may swing independently, being the aggregate clear width of the two openings on each side of the central shaft.

Sec. 3314. Radiators.

No coil or radiator, or steam riser shall be placed in a stairway, passageway, hallway or other means of exit, nor in an aisle of a floor-area in which seating accommodation is provided, unless the same be placed in a recess formed in or by the walls or partitions and guarded by substantial metal screen for a height of not less than 6 ft.

PART XXXIV.

Chimneys, Smokestacks and Heating Apparatus.

§ 3401. Height of chimneys.
§ 3402. Chimney construction.
§ 3403. Fireplaces.
§ 3404. Woodwork around chimneys and fireplaces.
§ 3405. Metal smokestacks.
§ 3406. Vent flues.
§ 3407. Gas appliances.
§ 3408. Heat producing appliances.
§ 3409. Domestic ranges and stoves.
§ 3410. Commercial stoves and ranges.
§ 3411. Support and clearances of other heat producing appliances.
§ 3412. Smoke pipes.
§ 3413. Hoods.
§ 3414. Drying rooms.
§ 3415. Incinerators.
§ 3416. Ash pits.
§ 3417. Warm air heating and air conditioning in residences.
§ 3418. Air conditioning and ventilating systems in other than residences.
§ 3419. Steam and hot water pipes.
§ 3420. Boiler rooms.
§ 3421. Basement ceilings.
§ 3422. Oil burning equipment.

Sec. 3401. Height of chimneys.

Chimneys shall be carried to a height sufficient to protect adjoining buildings from fire and smoke, shall extend at least 4 feet above a flat roof, and shall extend at least 2 feet above any part of the roof covering within 6 feet horizontal distance for sloping roofs.

Sec. 3402. Chimney construction.

a. General. 1. A chimney shall not support more than its own weight. Piers or walls supporting loads may be bonded to the chimney masonry, however such loads shall be free of lateral thrust.

2. The masonry work and foundation of a chimney shall conform to the requirements of Part XXIV of this Code.

b. Smoke Flues. 1. All smoke flues, except as hereinafter provided, shall be constructed of brick or reinforced concrete not less than 4 inches thick, or of hollow terra cotta or concrete blocks not less than 6 inches thick, or of stone or plain concrete not less than 8 inches thick and shall be lined continuously from the lowest thimble or smoke chamber to the top of the chimney with well burnt terra cotta flue linings with cemented joints. The flue lining shall be built in as the chimney construction is carried up.

2. When the walls of a chimney are 8 inches thick of brick or of solid concrete the flue linings may be omitted, in which case the joints on the inside of flue shall be neatly struck.

3. Chimneys shall extend as nearly vertically as possible for the entire height.

c. Chimney Cap. Every chimney shall be properly capped with terra cotta, stone, concrete or other approved incombustible and weatherproof materials.

d. Chimney Corbels. No chimney wall shall be corbelled more than 6 inches and such wall must be at least 12 inches thick; provided the corbelling may equal the thickness of the wall, but not more than 8 inches, if such corbelling occurs on the four sides of the chimney at the same horizontal plane.

e. Flues in Party Walls. Flues in party walls shall have the outside of their linings not less than 4 inches from the party line, or, if unlined, the inside of the flue shall not be less than 8 inches from the party line.

f. Plaster Outside of Chimney. All chimneys of brick, terra cotta blocks, or concrete blocks shall be plastered on the outside where wood surfaces are within 2 feet of the chimney.

g. Cleanouts. There shall be provided a cast iron cleanout at the base of all flues.

h. Separation of Flue Linings. When two or more flue linings are contained in the same chimney they may be separated with 4 inches of masonry; provided that when such separation does not exist, the flues shall be staggered.

i. Flues for Medium Heat Appliances. When smoke flues are connected with hot water or low pressure boilers having a great area of over 10 square feet, bakers' ovens, hotel and restaurant ranges, smoke houses, and other medium heat appliances, other than incinerators, the flues shall be lined with 4 in. of fire brick laid in fireclay mortar, for a height of not less than 14 feet from a point 2 feet below the smoke connection. The chimney shall be of brick or reinforced concrete 8 in. thick, or of plain concrete, hollow terra cotta, or concrete blocks not less than ten inches thick.

j. Flues for High Heat Appliance. Smoke flues of cupolas, brass furnaces, porcelain baking kilns, high pressure boilers or other high heat appliances, shall be built with double walls, each not less than 8 in. thick, with an air space of not less than 2 in. between them. The flue shall be lined with 4 in. fire brick in addition to the required 8 in. thick inner wall.

k. Flues for Incinerators. 1. Grate less than 9 square feet. Flues hereafter constructed for non-fuel fired incinerators in which the grate of the combustion chamber does not exceed nine square feet, shall be encased in clay or shale brickwork not less than three and three-quarter inches thick and a flue lining.

2. Grate more than 9 square feet. Flues hereafter constructed for non-fuel fired incinerators in which the grate of the combustion chamber exceeds 9 square feet, shall be encased in clay or shale brickwork not less than three and three-quarter inches thick and a lining of fire brick not less than four and one-half inches thick for a distance of not less than thirty feet above the roof of the combustion chamber, and in clay or shale brickwork not less than eight inches thick beyond thirty feet above the roof of the combustion chamber.

3. Fuel fired incinerator. Flues hereafter constructed for fuel fired incinerators in residence-buildings, institutional-buildings, churches, schools and restaurants, shall be encased as required for non-fuel fired incinerators with grates exceeding 9 square feet, but the fire brick lining shall extend for not less than forty feet above the roof of the combustion chamber.

4. Spark arresters. All flues for non-fuel fired incinerators shall terminate in substantially constructed spark arresters.

Sec. 3403. Fireplaces.

a. Back and Sides. 1. The back and sides of fireplaces shall be at least 8 in. of brick or concrete, or if of hollow terra cotta or concrete blocks, shall be at least 8 in. thick with a 4 in. brick lining. There shall be not less than 8 in. of masonry between fireplaces.

2. The rough masonry walls between the flue linings and fireplaces may be omitted; provided, however, that not more than one flue lining on each side of the fireplace shall be left without rough masonry wall. Such exposed flue lining shall be protected with at least 4 in. of finished brickwork.

b. Hearths. All fireplaces shall have hearths of incombustible materials not less than 16 in. wide from finished facing and at least 8 in. longer on each side of finished fireplace opening, such hearth shall be supported on incombustible trimmer arch or slab.

c. Prohibited Use of Fireplace. No heater other than an electric heater or an approved gas appliance shall be placed in a fireplace which does not conform to the requirements of this section and is not provided with a flue.

Sec. 3404. Woodwork around chimneys and fireplaces.

1. All woodwork around chimneys shall be kept at least 1 in. clear of the masonry.

2. There shall be firestopping provided at each floor around the chimney, which will consist of a strip of sheet metal 6 in. wide securely nailed to the floor and butted against the chimney.

Sec. 3405. Metal smokestacks.

a. Construction. 1. Metal smokestacks, unless structurally self-supporting, shall be guyed securely, or firmly anchored to or otherwise supported by the building served thereby.

2. Clean out openings shall be provided at the base of every such stack.

b. Height. All such stacks shall extend to a height of not less than ten feet above the highest point of any roof within twenty-five feet.

c. Exterior Stacks. 1. Every stack, or part thereof, hereafter erected on the exterior of a building shall conform to the requirements of the Superintendent. The Superintendent may require plans to be submitted, showing the relation of the stack to neighboring buildings.

2. No such stack shall be nearer than 2 feet in any direction from a wall opening, exit, or fire escape.

d. Interior Stacks. 1. Every such stack, or part thereof, within a building shall be enclosed above the story in which the appliance served thereby is located, in walls of approved masonry or fire-partitions of at least 2 hour fire-resistive construction, with a space on all sides between the stack and the enclosing walls sufficient to render the entire stack accessible for examination and repair.

2. Where such a stack passes through a roof constructed of com-

bustible material, it shall be guarded by a galvanized iron ventilating thimble extending not less than nine inches below and nine inches above such roof construction. Such thimbles shall be of a size to provide a clearance on all sides of the stack of not less than eighteen inches; provided that for stacks of low heat appliances the clearance may be reduced to not less than twelve inches.

Sec. 3406. Vent flues.

Flues hereafter erected or used for venting appliances that give off grease or grease-laden fumes shall be constructed and used entirely independent of other flues and shall conform to the requirements of this Part for smoke flues.

Sec. 3407. Gas appliances.

The flues or outlet pipes for gas appliances shall conform with the requirements of Part XL of this Code.

Sec. 3408. Heat producing appliances.

1. For the purpose of this Code, heat producing appliances shall be classed as low, medium and high, as follows:

2. Low heat appliances are those in which the temperatures developed at the furnace do not exceed six hundred degrees Fahrenheit such as bake ovens, candy furnaces, coffee roasting ovens, core ovens, cruller furnaces, hot air engine furnaces, hot air, hot water and small steam heating furnaces and boilers, japanning ovens, rendering furnaces, stereotype furnaces, wood drying furnaces.

3. Medium heat appliances are those in which the temperatures developed at the furnace exceed six hundred degrees but do not exceed fifteen hundred degrees Fahrenheit, such as annealing furnaces (small) for glass or metal, charcoal furnaces, galvanizing furnaces, gas producers, smoke houses, steam boilers.

4. High heat appliances are those in which the temperatures developed at the furnaces exceed fifteen hundred degrees Fahrenheit, such as annealing furnaces, billet and bloom furnaces, blast furnaces, brass furnaces, cement, brick and tile kilns, coal and water gas retorts, cupolas, earthenware kilns, glass smelting furnaces, open hearth furnaces, porcelain baking and glazing kilns, welding furnaces.

Sec. 3409. Domestic ranges and stoves.

1. Stoves and ranges used for heating one apartment, or for

cooking, a laundry of a single family, whether burning solid, liquid or gaseous fuel, shall not be placed within eight inches from a combustible wall unless the combustible material in the wall is protected by a shield of metal or other approved incombustible material so attached as to preserve an open air space behind it and to extend from the floor to one foot above and six inches beyond the sides of such appliance. Wooden ceiling or shelving shall not be less than three feet above such apparatus.

2. Such appliances may be placed upon wood floors if there is sufficient clearance to assure proper ventilation; however such clearance must meet with the approval of the Superintendent.

Sec. 3410. Commercial stoves and ranges.

1. Stoves and ranges such as are used in kitchens of restaurants, hotels, clubs and similar establishments shall not be placed nearer than two feet from a combustible wall unless the combustible material in the wall is protected by six inch clearance, and the wall is not less than one hour fire-resistive construction and a shield of metal or other approved incombustible material with free circulation of air between it and the wall, extending at least two feet beyond each side of appliance and four feet above top.

2. The floor under such appliances shall be protected in a manner to meet with the approval of the Superintendent.

Sec. 3411. Support and clearances of other heat producing appliances.

a. General. 1. Except as hereinafter otherwise provided, heat appliances shall be mounted on the ground, or on floors of fireproof-construction or semi-fireproof-construction with incombustible flooring or surface finish, or on trimmer arches supporting hearths as required in this Code for fireplaces, in all cases extending not less than twelve inches beyond such appliance on all sides.

2. Except as hereinafter otherwise provided, the clear distance from combustible material, including plaster on combustible base, shall not be less than four feet above a low heat or medium heat appliance nor less than fifteen feet above a high heat appliance; provided that when a low heat or medium heat appliance is encased in brick or in incombustible protective covering not less than one and one-half inches thick such distance may be three feet.

3. Except as hereinafter otherwise provided, the clear distance

from combustible material, including plaster on combustible base, shall be not less than three feet on the sides and rear of a low heat or medium heat appliance, not less than ten feet on the side and rear of a high heat appliance; provided that when a low heat or medium heat appliance is encased in brick or in incombustible protective covering not less than one and one-half inches thick such distance may be two feet.

4. The clear distances from combustible material including plaster on combustible base, shall be not less than four feet in front of a low heat appliance, not less than eight feet in front of a medium heat appliance, and not less than thirty feet in front of a high heat appliance.

b. Non-Conforming Installations. In case the installation of an existing heat appliance does not conform to the requirements of this section for appliances hereafter installed, the Superintendent may direct such changes in the location of the appliance or in the construction surrounding it as may be necessary to remove existing fire hazards

Sec. 3412. Smoke pipes.

a. Connection with Flue. Except as otherwise provided in this Code, every smoke pipe shall connect with a smoke flue conforming to the provisions of this Code.

b. Restriction. No smoke pipe shall pass through a floor, nor through a roof unless such roof is of fireproof-construction or semi-fireproof-construction.

c. Protection to partitions. Smoke pipes shall not pass through combustible partitions; provided that smoke pipes from ordinary ranges and stoves may do so if they are guarded by double metal ventilated thimbles six inches larger in diameter than the pipe, or by steel tubes built in brick work or other approved fireproofing materials extending not less than eight inches beyond all sides of the tube.

d. Clearances. The clear distance between a smoke pipe or metal breeching and combustible material or construction, including plaster on combustible base, shall be not less than eighteen inches in the case of low heat appliances, and not less than thirty-six inches for medium or high heat appliances; provided that such clearances may be reduced one-half when such smoke pipes or breechings are protected with not less than one inch of asbestos or in some other approved manner and provided further that, in the case of smoke pipes used on ordinary heating or cooking stoves, such clearances may be nine inches but not less.

Sec. 3413. Hoods.

a. When Required. Ranges, candy kettles, cruller furnaces, and appliances for the frying of bakery or confectionery products, except ranges in dwellings or apartments of multi-family-houses, shall be provided with ventilating hoods and pipes to take off the smoke, gases and vapors; unless such appliances are enclosed and vented in an approved manner.

b. Location. Such hoods shall not be raised more than six and one-half feet above the floor. The width and breadth shall be not less than that of the appliance served thereby.

c. Construction. Such hoods and their pipes shall be constructed of incombustible materials. The pipes shall be connected with independent masonry flues, constructed as required for smoke flues for low heat appliances; provided that, in buildings heretofore erected when such masonry flues are not available, they may be connected with independent metal stacks outside the building; provided that, in either case, such flues or stacks shall be used for no other purpose.

d. Clearances. Such hoods shall be installed to have the clearance required for smoke pipes. Where the pipe passes through a partition, it shall be protected as required for smoke pipes.

Sec. 3414. Drying rooms.

Drying rooms or dry kilns hereafter placed within a building shall be constructed entirely of incombustible materials. When the heating pipes are not placed overhead, they shall be so shielded as to preserve at all times a clear space of not less than two inches between them and the contents.

Sec. 3415. Incinerators.

Incinerators constructed as an integral part of a building, for the reduction of garbage, refuse or other waste materials, shall be installed in accordance with the provisions set forth in the "Building Code, fifth edition, revised reprint, 1934 published by the National Board of Fire Underwriters."

Sec. 3416. Ash pits.

Ash pits or receptacles for ashes shall be of iron, brick, or other incombustible material. The walls of ash pits shall be of approved masonry not less than eight inches thick. The floor and, in case such ash pit is covered, the roof shall be of fireproof construction; provided that when such pit is not covered the ceiling of the room in which it is located shall be of fireproof construction.

Sec. 3417. Warm air heating and air conditioning in residences.

a. Application. This section applies to air duct systems in residences: that is, to systems such as are used for heating, ventilating or cooling or any combination of these functions (including air conditioning), either with or without a fan.

b. Classification of Systems. 1. High temperature systems are gravity warm air systems, systems that are hand-fired, systems that are automatically controlled with temperature limit controls that can be set above 200° F., and any system not conforming with the requirements for Low Temperature systems.

2. Low Temperature systems are those using low pressure steam or hot water for air heating, and those using automatically fired warm air furnaces equipped with a fan to circulate the air and with automatic temperature limit controls that cannot be set higher than 200° F.

c. Warm Air Supply Ducts of High Temperature Systems. 1. Such ducts shall be constructed entirely of noncombustible material equivalent in structural strength and durability to the following:

Ducts Not Enclosed in Partitions:

ROUND DUCTS

Diameter, Inches	Minimum Weight of Tin	Minimum Thickness of Galvanized Iron
Less than 12	IC (107 lb.)	30 U. S. Gauge
12 or more	IX (135 lb.)	28 U. S. Gauge

RECTANGULAR DUCTS

Width, Inches	Minimum Thickness of Galvanized Iron
Less than 14	28 U. S. Gauge
14 or more	26 U. S. Gauge

Ducts Enclosed in Partitions:

Width, Inches	Minimum Weight of Tin	Minimum Thickness of Galvanized Iron
14 or Less	IC (107 lb.)	30 U. S. Gauge
Over 14	IX (135 lb.)	28 U. S. Gauge

2. Linings used inside of ducts shall be fire-resistive.

3. Joints and seams of such ducts shall be securely fastened and made substantially air tight. Slip joints shall have a lap of at least one inch, and be individually fastened.

4. Such ducts shall be securely supported by metal hangers, straps, lugs or brackets. No nails shall be driven through the duct walls and no unnecessary holes shall be cut therein.

5. Portions of such ducts which run in the open, such as those which run approximately horizontal and near the ceiling, shall have clearances as follows:

- a. From metal ducts to combustible material, including wood lath and plaster—not less than one inch;
- b. From metal ducts to metal lath and plaster or other non-combustible finish attached to combustible material—not less than ¼-inch;
- c. For metal ducts covered with ½-inch or more of non-combustible insulating material—no clearance required;
- d. From ducts made of asbestos-cement or equivalent to combustible material—one-half that specified for metal ducts.

6. Where such ducts enter a floor, partition, or enclosure of combustible construction within a horizontal distance of six feet of the furnace, the duct shall be so arranged that heated air must travel at least six feet from the closest primary heating surface and change direction equivalent to at least 90 degrees before entering such floor, partition or enclosure. This is not intended to prohibit so-called pipeless furnaces.

7. Where such ducts enter the floor of the first story above that in which the furnace is situated, they shall be separated from all combustible material in the floor construction by at least 5/16-inch, unless the duct is of double wall construction with a continuous air space of not less than 5/16-inch between the inner and outer walls. Any remaining space around the duct where it enters the floor, whether the duct is single or double wall construction, shall be tightly filled with asbestos cement or other non-combustible insulating material.

8. Where such ducts are enclosed in combustible partitions, walls or concealed ceiling spaces.

- a. They shall be covered with not less than one thickness of asbestos paper weighing not less than 12 pounds per hundred square feet, with an air space of not less than 5/16 of an inch provided between the duct and combustible material, unless a non-combustible insulating covering of cellular type at least ¼-inch thick is provided (in metal lath and plaster partitions no air space is needed except from wood studs);

b. Or, such ducts shall be made double with a continuous air space of not less than 5/16 of an inch between the inner and outer walls;

c. Or, such ducts shall be of ¼-inch thick asbestos-cement or equivalent, separated from combustible material by an air space of at least ⅛-inch.

9. Where such ducts are located in closets they shall be covered with not less than ¼-inch air cell asbestos or its equivalent in approved fire-resistive insulating covering, properly protected against injury; or they shall be made double with an air space of not less than one inch between the inner and outer walls; or they shall be made double with an air space of not less than 5/16-inch between the inner and outer walls and covered with not less than 12-pound asbestos paper.

10. Where such ducts pass through, i. e., pierce a wall or partition of combustible construction, they shall be protected as specified in paragraph 9 of Section 3418, c. A metal thimble may be used to provide the double wall if the space between the duct and the thimble is not less than one inch. This space may be filled with noncombustible material or closed with metal collars.

11. Where the installation of such ducts in walls, floors or partitions requires the removal of any fire-stopping, the spaces around the duct at such points where fire-stopping was removed shall be tightly filled with asbestos, mineral wool or other noncombustible insulating material.

12. Where registers are placed in floors or walls of combustible construction, the register box shall be covered with 12-pound asbestos paper and a clear space of not less than 5/16-inch shall be left between the sides of the box and any combustible material.

13. Where registers are installed in the floor over the furnace (as in a so-called pipeless furnace) the register box shall be constructed double with an air space of not less than 4 inches between, except where the warm air passage is surrounded by a cold air passage.

d. Warm Air Furnace Controls of High Temperature Systems. 1. Warm air furnaces which have the fuel supply automatically controlled from a house thermostat shall be equipped with an approved automatic control to shut off the fuel supply whenever the air in the furnace bonnet or at the beginning of the main supply duct at a point not affected by radiated heat reaches a temperature not higher than 250° F. The control device shall be such that it cannot be set higher than 250° F.

2. Warm air furnaces equipped with a fan to circulate the air, which are fed by a stoker in which the stoker mechanism is automatically controlled from a house thermostat, shall be provided with an automatic over-run control to start the fan when the air in the furnace bonnet, or at the beginning of the main supply duct at a point not affected by radiated heat reaches a temperature not higher than 250° F. after the stoker and fan (in its normal operation) have been shut down as a result of a satisfied thermostat.

e. Warm Air Supply Ducts of Low Temperature Systems. 1. Construction and installation of such ducts shall comply with the provisions of paragraphs 1, 2, 3, 4, 5, 9, and 11 of Section 3417, c.

2. Where such ducts enter the floor of the first story above that in which the furnace is situated the space around the duct at such points shall be tightly filled with asbestos cement or other non-combustible insulating material.

3. Where such ducts enter a floor, partition or enclosure of combustible construction within a horizontal distance of 6 feet from the furnace, they shall be separated from the combustible construction by at least 5/16-inch for a distance of 6 feet from the primary heating surface of the furnace. This space at the point where it enters the floor or partition shall be tightly filled with asbestos cement or other non-combustible insulating material.

f. Warm Air Furnace Controls of Low Temperature Systems. Systems using automatically fired warm air furnaces equipped with a fan to circulate the air shall be equipped with an approved automatic control to shut off the fuel supply whenever the air in the furnace bonnet or at the beginning of the main supply duct at a point not affected by radiated heat reaches a temperature not higher than 200° F. The control device shall be such that it cannot be set higher than 200° F. Where such a furnace is stoker-fired it shall also be equipped with an automatic over-run control to start the fan when the air in the furnace bonnet or at the beginning of the main supply duct at a point not affected by radiated heat reaches a temperature not higher than 200° F. after the stoker and fan (in its normal operation) have been shut down as a result of a satisfied thermostat.

NOTE: These limiting temperatures recognize that the average operating conditions would result in a temperature not in excess of 175° F. entering the supply duct and lower temperatures in other parts of the system due to heat loss from the ducts.

g. Cold or Return Air Ducts. 1. Such ducts, except as required by paragraph 2 below, may be constructed of metal, of 1 inch (nominal) wood boards, or other suitable material, provided that no material more flammable than 1 inch wood boards shall be used.

2. Portions of such ducts within 6 feet of the heater shall be constructed in accordance with the provisions of paragraph 1 of Section 3417, c.

3. Where such ducts are installed in walls, floors or partitions their installation shall comply with the provisions of paragraph 11 of Section 3417, c, regarding fire-stopping.

4. Where spaces between studs in walls or partitions or spaces between joists in floors are used as ducts, the portions of such spaces so used shall be cut off from all remaining unused portions by tight fitting stops of sheet metal or of wood not less than 2 inches thick.

5. The interior of combustible ducts shall be lined with metal at points where there might be danger from incandescent particles dropped through the register, such as directly under floor registers and at bottom of vertical ducts.

6. Return air shall be conducted to the heater through continuous ducts, except that underfloor spaces may be used as ducts for return of air from rooms directly above provided such spaces are not over 2 feet in height to bottom of floor joists and are cleaned of all combustible material and are tightly and substantially enclosed. Air shall not be recirculated from any basement section not used for living quarters.

h. Air Filters. 1. Air filters shall be of a type that will not burn freely or emit large volume of smoke or other objectionable products of combustion when attacked by flames.

2. Liquid adhesive coatings used on filters shall have a flash point of 350° F., Cleveland open cup tester, or higher.

i. Electric Wiring and Equipment. Electric wiring and equipment shall be installed in accordance with Part XLI of this Code.

j. Air Cooling. 1. Mechanical refrigeration shall be installed in accordance with Part XLIV of this Code.

2. Heating equipment shall be installed in accordance with the provisions of this Part.

Sec. 3418. Air conditioning and ventilating systems in other than residences.

Air conditioning and ventilating systems, in other than residences shall conform with the requirements, of the Massachusetts Department of Public Safety, and also with the "Standard of the National Board of Fire Underwriters for the installation of Air Conditioning, Warm Air Heating, Air Cooling and Ventilating systems as recommended by the National Fire Protection Association."

Sec. 3419. Steam and hot water pipes.

a. Protection. Where steam or hot water heating pipes pass through partitions, there shall be an open space of not less than 1 inch on all sides of the pipe, unless such pipe is covered with corrugated asbestos or other approved insulation.

b. Pipe Covering. Covering or insulation used on steam or hot water pipes shall be of incombustible material.

c. Erection of Pipes. All heating pipes that are to be buried in partitions shall be in place before the lathing permit required in Section 207, is issued.

Sec. 3420. Boiler rooms.

1. Every steam boiler that carries more than fifteen (15) pounds per square inch pressure, hereafter installed in a building other than an industrial building, shall be located in a separate room or compartment; and separated from the rest of the building by a fire wall or fire partition, and by a floor and a ceiling of Type I construction.

2. No boiler or furnace shall be placed or maintained under a public corridor or passageway.

Sec. 3421. Basement ceilings.

All ceilings immediately over a furnace or boiler and for 2 feet on each side thereof, shall be of at least one hr. fire-resistive construction as provided in Part XXXVII.

Sec. 3422. Oil burning equipment.

The installation and use of oil-burning equipment shall conform with the regulations of the Massachusetts Department of Public Safety.

PART XXXV.

Fire Extinguishing Apparatus.

§ 3501. General.
§ 3502. Where required.
§ 3503. Standpipe and hose systems.
§ 3504. Sprinkler systems.
§ 3505. Inspection and tests.

Sec. 3501. General.

The owner of a building in which fire extinguishing apparatus is to be installed, altered or repaired, shall first make application to the Superintendent and obtain a permit therefor, in the manner specified in Section 207 of this Code.

Sec. 3502. Where required.

Fire extinguishing apparatus shall be installed where required by the Massachusetts Department of Public Safety and where required in Parts VI to XV inclusive of this Code.

Sec. 3503. Standpipe and hose systems.

The design and construction of standpipe and hose systems shall conform to the regulations of the "National Board of Fire Underwriters for the installation of standpipe and hose systems as recommended by the National Fire Protection Association."

Sec. 3504. Sprinkler systems.

The design and construction of sprinkler systems shall conform to the "Standard of the National Board of Fire Underwriters for the Installation of Sprinkler Equipment as Recommended by the National Fire Protection Association."

Sec. 3505. Inspection and tests.

All required fire extinguishing apparatus shall be inspected as the Superintendent shall require. Defective hose and other defective parts shall be replaced without delay on order of the Superintendent.

PART XXXVI.

Signs, Billboards, Marquees, Flag Poles.

§ 3601. Permits.
§ 3602. Regulations.
§ 3603. Signs and billboards within the fire district.
§ 3604. Definitions.
§ 3605. General.
§ 3606. Roof signs.
§ 3607. Wall signs.
§ 3608. Projecting signs.
§ 3609. Marquee signs.
§ 3610. Temporary signs.
§ 3611. Marquees.
§ 3612. Ground signs (billboards).
§ 3613. Penalty.

Sec. 3601. Permits.

a. *Building Department Permit.* A permit shall be obtained from the Superintendent prior to the erection of any sign, billboard or other advertising device, except those that are exempted in Section 3605, a, of this Part. A permit shall also be required for the erection of a marquee or flagpole, if such is erected on an existing building or structure. Each application for the erection of any sign or billboard shall be accompanied by the written consent, of the owner or lessee, of the property on which it is to be erected. Each application shall be accompanied with the required fee as specified in Section 208 of this Code.

b. *Other Permits.* No sign, advertising device, clock, marquee, barber pole, permanent awning or other like structure, projecting into or placed on or over the public highway a distance of more than 6 in., except poles, wires, conduits and appurtenances of steam railroad, street railways, telegraph and telephone, water, gas, electric light, heat and power companies, shall be placed or maintained in any public way until a permit therefor shall have been granted by the City Council and shall in other respects conform with the provisions of the city ordinance. The permit aforesaid shall be issued by the Superintendent of Streets and the fee for the same shall be one dollar.

Sec. 3602. Regulations.

No person, firm, association or corporation shall erect, display or maintain a billboard, sign or other outdoor advertising device unless the same conforms to the rules and regulations of the Division of Highways of the Department of Public Works, promulgated under the provisions of Sections 29-33 inclusive of Chapter 93 of the General Laws, and the provisions of this Part.

Sec. 3603. Signs and billboards within the fire district.

No sign or billboard shall be erected on any building within the fire district, with a greater area than 12 sq. ft. unless covered with incombustible materials, nor over 100 sq. ft. area unless of incombustible material, nor over 200 sq. ft. area unless of skeleton construction. Nor shall a ground sign be placed within 20 ft. of any building unless made of or covered with incombustible material. The top of any sign or billboard placed upon a building of Type 6 construction shall not be higher than 12 ft. above the eaves.

Sec. 3604. Definitions.

For the purpose of this Part the following definitions shall apply:

1. Roof sign: a sign erected, constructed or maintained upon the roof of a building.

2. Wall sign: a sign or poster affixed to the walls of a building or other structure, with the exposed face thereof in a plane parallel or almost parallel to the plane of said walls.

3. Projecting sign: a sign that is affixed to and extends outward from the wall of a building or other structure.

4. Marquee sign: a sign attached to or supported to a marquee.

5. Ground sign: a sign or billboard erected on the ground, and which is self supporting.

6. Temporary sign: a sign made of cloth, paper, or similar material, with or without frame.

7. Marquee: a marquee is primarily a sheltering device, canopy or roof that is affixed to and extends outward from the wall of a building or structure.

8. Flagpole: a pole that is constructed of metal or wood, and

erected on the roof or part of a building or structure or on the ground adjacent to a structure.

Sec. 3605. General.

a. Exemptions. The provisions of this Part, except as to safety, shall not apply to a sign not more than two feet in height, on or over a show window or door of a store or business establishment, announcing, without display or elaboration, only the name of the proprietor and the nature of his business; nor to a sign not exceeding one square foot of display surface, on a residence-building stating merely the name and profession of an occupant; nor to a sign, not exceeding ten square feet of display surface, on a public-building giving the name and nature of the occupancy and information as to the conditions of use or admission; nor to a wall sign not exceeding two and one-half square feet of display surface, nor a ground sign, advertising in either case the sale or rental of the premises upon which it is maintained; nor to street signs erected by the municipality; nor to temporary signs or banners authorized by the City Council.

b. Alterations. No display sign shall hereafter be altered, rebuilt, enlarged, extended or relocated except in conformity with the provisions of this Part.

c. Movable Parts. The changing of movable parts of signs that are designed for changes, or the repainting of display matter shall not be deemed to be alterations within the meaning of this Part.

d. Existing Signs. Nothing in this Part shall require the removal or discontinuance of a display sign that conforms with the provisions of this Part and is not altered, rebuilt, enlarged, extended or relocated.

e. Height of Signs. The top of any sign or billboard placed upon any building shall not be higher than the height allowed for any building upon that lot.

f. Construction and Wind Pressure. All signs shall be constructed, placed, supported and maintained so as not to be or become dangerous. And all signs shall be designed and anchored to withstand a wind pressure of not less than 30 pounds per square foot of net exposed area.

Sec. 3606. Roof signs.

1. A sign shall not be placed upon the flat roof of any building

so as to obstruct the free passage from one part of said roof to another, nor so as to interfere with any openings in such a roof. A sign that is placed upon the roof of a building shall not project beyond the exterior wall. A roof sign shall be so constructed as to leave a clear space of not less than 6 feet between the roof directly beneath the sign and the lowest part of the sign; and at least 5 feet between the vertical supports thereof. The face or back of every such sign shall be set back at least 4 feet from the face of an outside wall.

2. Every roof sign, including the uprights, supports and braces of the same, shall be constructed of metal; except that an ornamental moulding, and battens behind the metal facing, may be of wooden construction. The bearing plates of such a sign shall be securely anchored to the beams or joists of the roof that supports it with suitable bolts, plates or strap anchors.

3. A part of any roof sign that has a tight, closed or solid face shall not be more than 21 feet above the high point of the roof. A roof sign of skeleton steel construction that has letters or illustrations, of metal in outline only, may be erected to a height of 30 feet above the high point of the roof and not to exceed a total face area of 1250 square feet; or to a height of 45 feet above the high point of the roof and not to exceed to a total face area of 450 square feet; but in no case shall the portions of such a structure, covered and exposed to wind pressure, exceed 35 per cent of the area. All such signs shall be thoroughly secured to the buildings upon which they are installed, erected or constructed; and plans, diagrams and stress calculations of such signs shall be furnished the Superintendent, upon request.

4. Every roof sign and all its supports, braces, guys and anchors shall be kept in good repair, and, unless made of non-corrodible materials, shall be thoroughly painted at least every 2 years. The Superintendent may order the removal of all such signs that are not maintained in accordance with the conditions herein set forth.

5. Metallic parts of roof signs exposed to lightning shall be adequately grounded.

Sec. 3607. Wall signs.

1. A wall sign that has a minor dimension in excess of 2 feet or a major dimension in excess of 45 feet shall not be constructed of combustible materials, except a temporary sign. A wall sign that has a minor dimension greater than 2 feet, but less than 6 feet and does not exceed 135 square feet in area, may be constructed of combus-

tible materials; provided the exposed face of such a sign is of metal. Every wall sign that has a minor dimension of 6 feet or more, or is more than 135 square feet in area, shall be constructed throughout of incombustible materials, except for an ornamental wooden moulding that does not exceed 2 inches by 8 inches in size.

2. Every wall sign shall be safely and adequately attached to the building or other structure. Electric wall signs shall be constructed wholly of incombustible materials, with metal frames and supports.

3. A wall sign, that projects more than 6 inches over the street line shall be constructed of incombustible materials, with a metal frame and supports.

Sec. 3608. Projecting signs.

1. A projecting sign shall be constructed wholly of incombustible materials, with a metal frame and supports; shall not project out from the wall of a building or other structure a horizontal distance of more than 6 feet; and shall be secured in a rigid manner.

2. Any part of such a sign shall not be less than 10 feet, nor more than 45 feet, above the grade beneath the sign.

Sec. 3609. Marquee signs.

A marquee sign shall be constructed wholly of incombustible materials, with a metal frame and supports; and shall not be located less than 10 feet, nor extended more than 16 feet, above the grade. No part of such a sign shall extend over or beyond the extreme edge of the marquee.

Sec. 3610. Temporary signs.

A temporary sign shall not exceed 400 square feet in area. Such a sign shall be placed flat against the building or other structure; and may remain in place for an interval of not more than 60 days.

Sec. 3611. Marquees.

1. A marquee shall be equipped with gutters or other devices, and conductors for the purpose of draining water toward the building to which it is attached; and shall not discharge ice, water or snow onto the street or walk. If a marquee is to be glazed, it shall be glazed with wire glass not less than ¼ of an inch in thickness.

2. Any part of a marquee shall not be located less than 10 feet,

nor extended more than 16 feet, above the grade beneath it and shall conform to Section 3102, e, as to its projection over a public way.

3. A marquee constructed within the fire district shall be entirely of metal or other incombustible materials. All marquees shall be so erected as not to be or become dangerous to property or persons; and shall safely support their own weight plus a uniformly distributed live load of 30 pounds per square foot in addition to any concentrated loads to which it may be subjected.

Sec. 3612. Ground signs (billboards).

Ground signs shall have a space of at least 4 ft. between the ground and the bottom of the sign. Such space shall be entirely open, except for the supporting members.

Sec. 3613. Penalty.

Whoever violates any provision of this Part shall be punished by a fine of not more than 20 dollars.

PART XXXVII.

Fire Resistive Standards.

§ 3701. Fire resistive construction defined.
§ 3702. Fire resistive materials and construction.
§ 3703. Fire resistive ratings.
§ 3704. Approved fire resistive doors, windows and shutters.
§ 3705. Fire resistive roof covering.

Sec. 3701. Fire resistive construction defined.

1. Mention has been made in various Parts of this Code of fire-resistive ratings of construction as 4 hour, 3 hour, 2½ hour, 2 hour, 1½ hour, and 1 hour. Such ratings shall mean that building materials, assemblies and forms of construction shall comply with the requirements of this Part for a given rating.

2. Other materials, assemblies and combination of materials not specified in this part may be used when such materials and assemblies have been given a fire rating, determined by performances shown under tests made in accordance with "Fire Tests of Building Construction and Materials" A. S. T. M. and approved by the Superintendent.

Sec. 3702. Fire resistive materials and construction.

a. Burned Clay, Concrete, Gypsum Units. All fire-resistive construction of burned clay, concrete or gypsum units, or other similar units, shall be solidly bedded and laid in gypsum mortar, lime-cement mortar or cement mortar; provided that gypsum units shall be laid in gypsum mortar only. All such units shall be thoroughly bonded together by broken joints in alternate courses or by sufficient approved metal ties or bonds. Cast poured, or similarly applied concrete, gunite, gypsum or other protection for steel or iron structural members shall be reinforced sufficiently to prevent cracking or disintegrating.

b. Plaster. 1. Plaster for fire protection shall consist of gypsum mortar, Portland cement mortar, or other equally fire resistant materials. Gypsum plaster only shall be used for plastering on gypsum units. Wherever plaster is used for fire protection purposes, it shall be reinforced with a metal mesh or lath, except that where plaster is placed on masonry or reinforced concrete such reinforcing may be omitted when the plastering is not more than 1 inch thick. When plastering is required, but the material and thickness are not given, it shall be not less than ½-inch gypsum or Portland cement plaster.

2. Unless otherwise specified plaster for fire protection shall not be leaner than the following:

Gypsum plaster: 1 part gypsum, 2 parts sand.

Portland cement plaster: 1 part cement, 2 parts sand, 1/10 part lime.

3. The thickness of plaster protection, where required, shall be measured from the face of the plaster to the plane of the back surface of the metal lath where such lath is used (unless otherwise noted).

4. The weight of metal lath, when used, shall be not less than 2.2 pounds per square yard, unless otherwise stated.

c. Gunite. Gunite applied to masonry need not be reinforced when properly bonded and may be considered a part of the required thickness.

d. Cinders. Cinders for concrete aggregate shall conform with the provisions of Section 2709, 1, b.

e. Concrete Aggregate. The aggregate for concrete protection shall be as follows:

1. Coarse aggregate "A" is limestone, calcareous gravel, traprock, blast furnace slag, burnt clay or shale.

2. Coarse aggregate "B" is granite, sandstone or cinders.

3. Coarse aggregate "C" is siliceous gravel. (More than 60 per cent quartz, chert, flint or similar materials.)

f. Thickness of Concrete Protection. The thickness shown shall be measured outside the reinforcement for reinforced concrete members and outside the extreme edges of structural shapes except that projecting edges of lugs and brackets shall have a minimum of 1 in. protection.

g. Column Protection. All interior or re-entrant spaces of columns shall be filled with concrete or the same material as the protection, unless otherwise noted.

h. Metal or Wire Mesh. Metal or wire mesh for preventing spalling of poured protections for columns, beams or girders shall weigh not less than 15 lbs. per square yard and mesh shall measure not greater than 4 inches by 4 inches. Wire ties for poured concrete protections shall be of not less diameter than No. 5 B. & S. gauge and shall be spaced not more than 8 inches.

i. Bonding of Masonry Units. Masonry units in order to provide adequate protection shall be well anchored or bonded.

j. Thickness of Walls and Partitions. Thicknesses of walls and partitions refer to total thickness of the construction exclusive of plaster, except solid plaster partitions. The ratio of height of partition to thickness is not to exceed 30, unless partition is rigidly anchored at top and bottom. The thickness of the wall or partition must be sufficient for strength, as well as for fire resistance, and shall conform with the provisions of Part XXIV.

k. Combustible Members in Masonry Walls. Combustible members framing into masonry walls, shall conform with the provisions of Section 2413. When unprotected steel members frame into hollow walls, the space above, below, and between them and the opposite face of the wall shall be filled solidly with burnt clay materials, mortar, concrete, or equivalent fire-resistive materials to a depth or thickness of not less than 4 in.

l. Breaks in Walls. No 8 in. fire-resistive wall shall be broken into subsequent to its erection, for insertion of structural members, chases and recesses shall conform with the provisions of Section 2428, b.

m. Tile Blocks. All open cells in tile blocks occurring at wall ends shall be filled solid with concrete or cement mortar for at least a depth of 6 inches, or closure tile set in the opposite direction shall be used.

n. Steel Joists. Steel joists shall conform to the provisions of Section 2618.

o. Substitutions. One-half inch gypsum plaster may replace an equal thickness of poured gypsum, ½-inch gypsum or Portland cement plaster may replace an equal thickness of the required poured concrete, and 1 inch gypsum or Portland cement plaster reinforced with expanded metal lath or wire lath may replace an equal thickness of poured protection.

Sec. 3703. Fire resistive ratings.

a. General. Compliance with the following tables shall be deemed to give the necessary fire resistance periods for the situations to which they apply.

b. Fire Resistance Ratings for Walls and Partitions.

TABLE 3703 A

Type	Construction See Section 3702	Minimum thickness in inches for hours given				
		4	3	2½	2	1 hrs.
Brick (Clay, Shale Concrete or Sand-Lime)	Solid	8	..	..	..	3¾
	Solids; plastered both sides	..	..	..	3¾	..
	Hollow	12	..	8	..	..
	Hollow; plastered both sides	8	..	..	..	..
	Hollow Rolok-Bak; plastered one side	8	..	..	..	..
Fire Clay Units	Vertically cored; voids not exceeding 25%; plastered side scored; ¾" gypsum plaster (1:3)	..	..	..	3⅞	..
Hollow Clay Tile	2 units; 3 cells in wall thickness	12	..	..	..	..
	2 units; 4 cells in wall thickness	..	8	..	..	..
	2 cells in wall thickness; plastered both sides	8	..	..	6	..
	2 cells in wall thickness; plastered one side	..	..	..	8	..
	3 cells in wall thickness	..	12	..	8	..
	3 interior cells and double shells	..	..	8	..	..
	T-shaped; 2 cells in wall thickness	..	..	8	..	..
	Plastered on both sides	..	..	..	..	3

TABLE 3703 A (Cont'd)

Type	Construction See Section 3702	Minimum thickness in inches for hours given				
Hollow Concrete Units	2 cells in thickness of wall	12	..	..	..	..
	1 cell in thickness of wall	..	12	..	..	4
	1 cell in thickness of wall plastered both sides	..	..	..	4	3
	1½″ shells; plastered both sides	8	..	..	..	..
	1½″ shells; plastered one side	..	8	..	..	..
	1½″ shells	..	..	..	8	..
	1½″ shells; burnt clay or shale aggregate	..	8	..	..	..
	1½″ shells; coarse aggregate limestone or calcareous gravel	..	..	8	..	..
	2″ shells; coarse aggregate cinders, limestone or calcareous gravel	..	8	..	..	..
	2″ shells; coarse aggregate cinders, plastered both sides	..	6	..	..	..
	2″ shells	..	..	8	..	..
Combination	Hollow clay or concrete tile faced with 3¾″ brick, limestone or terra cotta; plastered one side	4	..	..	..	..
	Hollow clay or concrete tile faced with 3¾″ brick, limestone or terra cotta	8	..	..	..	..
	Hollow concrete tile; faced with 3¾″ brick, limestone or terra cotta	..	4	..	..	..
Gypsum Units	Hollow; plastered both sides	..	..	..	3	..
	Hollow	..	..	..	..	3
	Solid; plastered both sides	..	..	..	..	2
Reinforced Concrete	0.2 per cent reinforcement in each direction; ¾″ maximum size aggregate	6	5	..	4	3
	0.2 per cent reinforcement in each direction; ¾″ maximum size aggregate; plastered both sides	..	..	..	3	..

TABLE 3703 A (Cont'd)

Type	Construction See Section 3702	Minimum thickness in inches for hours given				
Solid Plaster Partitions	Neat wood-fibered gypsum plaster; metal or wire lath; incombustible studding 12″ oc	..	..	2¼	2	..
	Sanded gypsum plaster (1:2½); metal or wire lath; incombustible studding 12″ oc	..	..	..	..	2
	Sanded gypsum plaster (1:2½); metal or wire lath; incombustible studding 12″ oc	..	..	..	..	2½
	Portland cement plaster (1:1/10:2); metal or wire lath; incombustible studding 12″ oc..............	..	..	..	..	2½
Hollow Partitions	⅝″ neat wood-fibered gypsum plaster on ⅜″ gypsum plaster board; incombustible studding 24″ oc ..	..	..	..	..	*
	½″ neat wood-fibered gypsum plaster on ⅜″ gypsum plaster board; combustible studding (2″ x 4″ min.) 16, oc 3″ wide metal lath strips over plaster board joints	..	..	..	..	*
	½″ sanded gypsum plaster (1:2) on ⅜″ perforated gypsum plaster board; combustible studding (2″ x 4″ min.) 16″ oc	..	..	..	..	*
	¾″ gypsum or Portland cement plaster on metal or wire lath; incombustible studding 24″ oc, or combustible studding (2″ x 4″ min.) 16″ oc	..	..	..	..	*
	1″ neat wood-fibered gypsum plaster on metal or wire lath; combustible studding (2″ x 4″ min.) 16″ oc, non-bearing	..	..	..	*	..
	⅞″ neat wood-fibered gypsum plaster on ⅜″ ribbed metal lath; 3⅝″ steel studs 24″ oc; weight of metal lath not less than 3¼ lbs. per sq. yd.	..	..	*	..	..

*Indicates fire resistance of construction. Construction shown required on both sides.

c. Fire Resistance Ratings for Protection of Columns, Beams, Girders and Trusses.

TABLE 3703 B

Structural Parts		Protection See Section 3702 Hrs.	Minimum thickness in inches for hours given 4	3	2½	2	1½	1
Steel Columns	Concrete	Coarse aggregate "A"	2	..	..	1½	..	1
		Coarse aggregate "B", wire ties or metal mesh	2½	2	..	1½	..	1½
		Coarse aggregate "C", wire ties or metal mesh	3	..	..	2	..	1½
	Brick	With brick fill	3¾	..	..	2¼	..	..
		With outside wire ties	..	2¼	..	..	..	..
	Hollow Clay Tile	Two 2" layers; metal mesh in horizontal joints	4	..	..	..	..	..
		"A" concrete fill; plastered	4	..	..	..	..	..
		Limestone concrete fill; wire mesh in horizontal joints; ¾" plaster	2	..	..	..	..	..
		¾" shells and webs, concrete fill; plastered	2	..	..	..	..	..
		"A" concrete fill; fill extending ¾" outside of flanges	..	2	..	..	..	..
		Plastered or unplastered	..	..	..	2	..	..
		No fill	..	..	..	..	..	2
	Concrete Block or Tile	Hollow; plastered	4	..	..	..	..	..
		Solid; cinder aggregate; plastered	3	2	..	..	..	..
		Solid; cinder aggregate unplastered	..	..	..	2	..	..
		Hollow; no fill	..	..	..	..	..	2
	Gypsum	Cast in place; wire mesh reinforcing	2	1½	..	1	..	..
		Solid block; no fill; plastered	2	..	..	..	..	..
		Solid block, no fill	..	..	..	2	..	..
		Hollow block; no fill, plastered	3	..	..	..	..	..
		Hollow block, no fill	..	..	..	3	..	..

TABLE 3703 B (Cont'd)

Structural Parts		Protection See Section 3702	Minimum thickness in inches for hours given					
		Hrs.	4	3	2½	2	1½	1
	Plaster on Metal or Wire Lath	Two ⅞″ layers with ¾″ air space between	..	..	..	2½	..	..
		One 1″ layer; no fill	..	..	..	..	..	1
	Concrete	Coarse aggregate "A"	..	2	..	1½	..	1
		Coarse aggregate "B" or "C" wire ties or mesh	..	3	..	2	..	1½
Cast Iron Columns		Hollow clay tile; 2″ thickness over ¾″ mortar	..	2	..	..	..	..
		Concrete block on tile; hollow; over ¾″ mortar	..	2	..	..	..	..
		Plaster; on expanded metal or wire lath	..	..	..	..	..	1
Reinforced Concrete Columns	Concrete	Coarse aggregate "A"	1½	..	..	..	..	..
		Coarse aggregate "B" or "C"; ¾″ maximum size	2	1½	..	..	..	..
	Concrete	Coarse aggregate "A", wire ties or mesh for 4 hrs.	2	..	1½	..	1	..
		Coarse aggregate cinders, wire ties or mesh for 4 hrs.	2	..	1½	..	..	..
		Coarse aggregate "B", wire ties or mesh for 4 hrs.	2½	..	1½	..	..	..
		Coarse aggregate "C", wire ties or mesh	3	..	2	..	..	1½
Steel Beams Girders Trusses	Concrete Tile or Block	Hollow clay tile; plastered	3	2	..	..	..	..
		Solid or hollow; plastered	3	2	..	..	..	..
		Solid cinder units	..	3	..	..	2	..
	Gypsum	Cast in place	2	1½	..	1	..	..
		Solid block; plastered	2	..	..	..	..	..
		Hollow block; plastered	3	..	..	..	..	..
		Plaster; on expanded metal or wire lath	..	..	..	..	1	¾
Reinforced Concrete Beams, Girders and Trusses	Concrete	Coarse aggregate "A", including cinders	1½	..	..	..	..	..
		Coarse aggregate "B" or "C"; ¾″ maximum size for "C"	2	1½	..	..	..	..

d. *Fire Resistance Ratings for Various Floor and Roof Construction.*

TABLE 3703 C

Type	Construction (See Section 3702)		Minimum thickness for hours given		
			2½	1½	1 hr.
Solid Slab	Reinforced concrete		4½	3½	3
	Gypsum; cast in place; plastered		4	..	..
Arches	Brick; concrete fill level with crown		3¾	..	..
	Flat; 2-cell 8″ hollow clay tile; 2″ incombustible fill; plastered		10	..	..
	Segmental; 2-cell 6″ hollow clay tile; concrete fill level with crown; plastered		6	..	..
Reinforced Concrete Joists	Top slab, no ceiling	Not more than 24″ between joists	3½	3	..
		Not more than 36″ between joists	4	..	..
	Top slab with ceiling of ¾″ plaster on metal or wire lath	Not more than 24″ between joists	2½	2	..
		Not more than 36″ between joists	3	..	..
	Top slab 2″ concrete; 4″ fillers of hollow tile, cinder concrete block, slag block or gypsum block. Total thickness		6	..	..
	No top slab; 6″ fillers of hollow tile, cinder concrete block, slag block or gypsum block, plastered		..	6	..
Steel Joists Light Steel Construction	Top slab 2″ poured or precast concrete or gypsum	Bottom slab poured or precast gypsum; plastered	2	..	..
		Ceiling, Portland cement or gypsum plaster on metal lath	1½	¾	..
		Ceiling neat wood-fibered gypsum plaster on metal lath	1	⅝	..
Wood Joists	Fire-stopped double board floor, approved insulating layer between	Ceiling Portland cement or gypsum plaster on metal or wire lath	..	..	¾
		Ceiling wood-fibered gypsum plaster on ⅜″ gypsum plaster board or sanded gypsum plaster (1:2) on ⅜″ perforated gypsum plaster board. Metal lath strips 3″ wide over plaster board joints	..	..	½

Sec. 3704. Approved fire resistive doors, windows and shutters.

a. General. Fire doors, windows and shutters bearing the label of the "Underwriter's Laboratories Incorporated", as suitable for given locations and conditions, and installed in accordance with this Section shall be deemed to be approved within the meaning of this Section.

b. Installation of Fire Doors. 1. Fire-resistive doors, when closed, shall completely cover the doorways in the walls and partitions or the openings in the floors or roofs to which they are fitted. A swinging fire door shall either overlap both jambs and the head of the opening not less than four inches or be fitted to a fire-resistive frame with a rabbet the full thickness of the door and with not less than one-half inch overlap on the door. A sliding fire door, except in enclosures about passenger elevators, shall overlap both jambs and the head of the opening not less than four inches. A sliding fire door in an enclosure about a passenger elevator shall overlap jambs, head and adjoining panels not less than one-half inch. Fire door shall fit closely at the floor with clearance of not over one quarter inch.

2. In buildings with combustible floors, doorways required to have fire doors shall have incombustible thresholds the full thickness of the wall, extending at least four inches from the face of the wall where a door is hung and extending laterally at least six inches beyond each jamb of the doorway. Thresholds may be flush with the floor.

3. The rabbeted frame of a swinging fire door shall be constructed of structural steel built into the concrete, masonry or other fire-resistive material of the wall about the opening and secured thereto, except that the rabbetted frame of a Class B or Class C door may be of wood, covered with sheet metal not less than twenty-six gage in thickness, secured to the wall in the opening.

4. Fire doors when closed shall fit tightly against the wall or frame so as to provide an effective stop for fire and smoke. Except for the metal-covered wooden frame specified in this Section, combustible material shall not intervene between the door and the fire-resistive material of the wall, floor or roof to which it is fitted.

5. Hardware for fire doors shall be of malleable iron or rolled structural steel not less than one-fourth inch thick except that tubular steel track for sliding doors may be not less than one-eighth inch thick. Fire doors shall not depend upon cords, cables or chains to support them in closed position, except in elevator shafts.

6. Tracks for sliding fire doors shall be so supported that a track hanger comes at each door hanger when the door is closed. Track hangers shall be secured to wood stud walls by screws or bolts, to steel stud walls by bolts or rivets, to masonry walls by through bolts and to concrete walls by through bolts or approved built-in inserts. Expansion shields shall not be used to support fire doors.

7. Hinges for swinging fire doors, except in wooden stud walls, shall be riveted or through-bolted to the structural steel frame of the opening, through-bolted to the wall if of masonry or concrete or secured by approved inserts in the concrete or built into masonry in approved manner.

8. Strap hinges and sliding door hangers shall be secured to fire doors by through-bolting, riveting or welding. Swinging fire doors in rabbeted frames, except tin-clad, wood core doors, may be hung on butts. Other swinging fire doors shall have long strap hinges.

9. Sliding fire doors shall have adequate stops for the closed position. Swinging Class A fire doors shall have surface latches or unit locks. Class B and Class C doors shall have surface latches, unit or mortise locks. The latch bolts of unit or mortise locks on fire doors shall have a throw of three fourths inch. When mounted in pairs fire doors shall be rabbeted by means of an astragal or otherwise where they come together. One of a pair of swinging fire doors shall have push bolts at top and bottom with a throw of three-fourths inch and the other shall be held by latch to the first.

10. Except in detention buildings, fire doors hung in required exit shall be so fitted with hardware that they can be opened from inside without use of a key when the building is occupied.

c. Shutters. Shutters required to be fire shutters or fire-resistive shutters shall be constructed and hung as specified for Class B fire-resistive doors in this Section.

d. Fire-Resistive Windows. 1. Windows which are required to be fire windows, fire-resistive windows, or of fire-resistive construction shall conform to the requirements of this Section.

2. Fire-resistive windows may be fixed or arranged to open and close. Fixed fire-resistive windows shall be so secured in the walls in which they are placed that they may expand in case of fire without buckling. Movable fire-resistive windows shall be opened or closed in a manner approved by the Superintendent.

3. Movable sashes in fire-resistive windows shall be fitted to fire-resistive frames of the same or similar construction. Both sashes and frames, and metal mullions between window units shall

be so fitted in the walls in which they are placed as to be continuous with the fire-resistive material of the wall and so secured that they may expand in case of fire without buckling.

4. Glass in fire-resistive windows shall be wire glass not less than one-fourth inch thick and the area of a single light shall not exceed seven hundred and twenty square inches. Glass shall be set three-eighths inch in grooves at least one-half inch deep. Glass shall be secured by glazing angles or moldings bolted to the sash and forming continuous grooves for the glass.

Sec. 3705. Fire resistive roof covering.

a. General. Roof covering allowed under this Code shall be classified as fire-retardant or ordinary, according to its resistance to fire outside, as provided in this Section. Fire-retardant roof covering is the more fire-resistive and may be used on any building. Ordinary roof covering shall not be used where fire-retardant roofing is specified. Roof covering less fire-resistive than ordinary roof covering shall not be used on any building.

b. Fire-Retardant Roofing. Roof covering within the fire district (See Part IV) shall be fire-retardant roofing and shall be any roof covering which meets the requirements of Class A or Class B roofing under the specifications of the Underwriters' Laboratories, Inc. The following roof covering shall be assumed to meet the requirements for fire-retardant roofing:—

1. Built up roofing consisting of successive layers of roofing felt impregnated with asphalt; a final layer of asphalt in which, while molten, is embedded a continuous layer of roofing gravel or slag.

2. Built up roofing consisting of successive layers of roofing felt impregnated with coal tar; a final layer of tar in which, while molten, is embedded a continuous layer of roofing gravel or slag.

3. Built up roofing consisting of successive layers of roofing felt impregnated with asphalt weighing not less than fourteen pounds per hundred square feet, or a final layer of asphalt-saturated prepared roofing coated with granulated slate or other similar material.

4. Built up roofing consisting of successive layers of roofing felt impregnated with tar or asphalt and a finish of burned clay floor tile, stone flagging, cement concrete or other similar material.

5. Sheet metal with locked and soldered joints not less than number twenty-six gage in thickness.

6. Shingles of natural slate.

7. Shingles of burned clay tile.

8. Shingles of sheet metal not less than number twenty-six gage in thickness.

9. Shingles of asbestos boards not less than one-eighth inch thick.

10. Shingles of asphalt-saturated felt surfaced with granulated slate or other similar material and weighing not less than one hundred and ninety pounds per one hundred square feet of roof covered.

11. Corrugated sheet metal with lapped joints not less than number twenty-six gage in thickness.

12. Corrugated asbestos board not less than three sixteenths inch thick.

c. Ordinary Roofing. Ordinary roofing may be used outside of the fire district (See Part IV) and shall be any roof covering which meets the requirements of Class C roofing under the specifications of the Underwriters' Laboratories, Inc. The following roof covering shall be assumed to meet the requirements for ordinary roofing:—

1. Built up roofing consisting of successive layers of roofing felt impregnated with asphalt, coal tar or other approved material, not equal in fire-resistance to a fire-retardant roofing.

2. Prepared roofing consisting of felt or fabric impregnated or coated, or both, with asphalt, tar or other approved material or shingles of such prepared roofing, not equal in fire-resistance to fire-retardant roofing.

3. Canvas stretched tightly and coated with paint.

d. Construction. Built up roofing shall be secured to the roof deck by laying the first layer in molten asphalt or tar mopped on the roof deck, or by nailing a layer of building paper to the roof deck over which the roofing felt is laid in molten asphalt or tar. Unless so secured, prepared roofings and shingles, slates, tile, and other roofing, except roof covering weighing not less than fifteen pounds per square foot on a flat roof, shall be well secured to the deck by nailing, bolting, wire or other approved method.

PART XXXVIII.

Elevators and Escalators.

§ 3801. General.
§ 3802. Shafts.

Sec. 3801. General.

Unless otherwise provided in this Code, elevators and escalators shall be installed in buildings and other structures in accordance with the provisions of Sections 62 to 71 inclusive, of Chapter 143 of the General Laws.

Sec. 3802. Shafts.

1. Elevators hereafter installed in buildings, and other structures, except as otherwise provided in this Code, shall be inclosed with masonry walls or with fire partitions which do not depend upon wood for their support; and which have a fire-resistive rating of at least 2 hrs., as specified in Part XXXVII. Landing openings in such shaftway enclosures shall be provided with fire resisting doors and frames without open grille work, movable panels, or other openings. Kalamein doors, hollow metal doors, steel frame doors glazed with wire glass, or doors of similar construction shall be considered as fire resisting. When an elevator shaft extends into a basement or cellar, such partition of the shaft, including the space occupied by the machinery, shall be constructed of brick or concrete and shall be fitted with automatic fire doors not less than 1¾ in. thick. When such a shaft is not placed next to an outside wall with window openings therein, it shall be carried at least 3 ft. above the roof of the building and covered with a skylight. If skylight is omitted the ceiling shall be covered with at least a 1-hr. fire-resistive construction.

2. The above requirements as to shaft enclosures shall not apply to electric elevators that serve only 2 floors in a one family dwelling: provided the size of the platform of the elevator car does not exceed 36 in. by 40 in. and the elevator does not have a rate of speed greater than 28 ft. per minute; provided also that the motor required is of no greater capacity than 1 horsepower and is not fused in excess of 25 amperes at 110 volts.

3. The shaft for an elevator hereafter erected in a single family dwelling and the shaft for a dumb-waiter hereafter erected in any building may be constructed of combustible framework, including

the space occupied by the machinery, provided the entire outside and inside surfaces of the framework, including the ceiling, are covered with 1 hr. fire-resistive construction; or they may be constructed of incombustible material throughout and covered on the outside with 1 hr. fire-resistive construction. Openings into such shaft-ways shall be provided with fire-resistive doors and frames.

PART XXXIX.

Plumbing.

§ 3901. General.
§ 3902. Definitions pertaining to plumbing.
§ 3903. Regulations.
§ 3904. Quality and weights of materials.
§ 3905. Joints and connections.
§ 3906. Traps and clean outs.
§ 3907. Water supply and distribution.
§ 3908. Plumbing fixtures.
§ 3909. Hangers and supports for plumbing piping.
§ 3910. Ventilation of rooms and fixtures.
§ 3911. Soil, waste, and vent pipes.
§ 3912. House drains and sewers.
§ 3913. Storm-water drains.
§ 3914. Inspections and tests.
§ 3915. Maintenance.
§ 3916. Steam exhausts.
§ 3917. Drip or overflow pipes.
§ 3918. Septic tank.
§ 3919. Cesspools.

Sec. 3901. General.

a. Licenses. No person shall engage in the business of a master plumber or work as a journeyman plumber unless he is lawfully licensed by the State Examiners of Plumbers. Every master plumber's license, or certificate shall at all times be displayed conspicuously within his place of business. The license of a journeyman plumber shall be exhibited whenever required by an Inspector of Plumbing. Every master plumber engaging in business as such in the City of Cambridge shall register his name and place of business in the Building Department on May 1st of each year.

b. Permits. Every plumber, before doing any work in a building, except in the case of repair of leaks, shall file at the office of the

Superintendent, upon blanks for that purpose, an application for a permit, and, if required by the Superintendent, a plan or sketch of the work to be performed; and no such work shall be done in any building without a written permit from the Superintendent. Permits shall be issued only to Master Plumbers who are registered as required under Section 3901 a.

Sec. 3902. Definitions pertaining to plumbing.

a. Plumbing. Plumbing is the art of installing in buildings the pipes, fixtures, and other apparatus for bringing in the water supply and removing liquid and water-carried wastes.

b. Plumbing System. The plumbing system of a building includes the water supply distributing pipes; the fixtures and fixture traps; the soil, waste, and vent pipes; the house drain and house sewer; the storm-water drainage; fire lines, except sprinklers, and air conditioning connections; with their devices, appurtenances, and connections all within or adjacent to the building.

c. Water-Service Pipe. The water-service pipe is the pipe from the water main to the building served.

d. Water-Distribution Pipes. The water-distribution pipes are those which convey water from the service pipe to the plumbing fixtures.

e. Plumbing Fixtures. Plumbing fixtures are receptacles intended to receive and discharge water, liquid, or water-carried wastes into a drainage system with which they are connected.

f. Trap. A trap is a fitting or device so constructed as to prevent the passage of air or gas through a pipe without materially affecting the flow of sewage or waste water through it.

g. Trap Seal. The trap seal is the vertical distance between the crown weir and the dip of the trap.

h. Vent Pipe. A vent pipe is any pipe provided to ventilate a house-drainage system and to prevent trap siphonage and back pressure.

i. Local Ventilating Pipe. A local ventilating pipe is a pipe through which foul air is removed from a room or fixture.

j. Soil Pipe. A soil pipe is any pipe which conveys the discharge of water-closets, with or without the discharges from other fixtures, to the house drain.

k. Waste Pipe and Special Waste. A waste pipe is any pipe which receives the discharge of any fixture, except water-closets, and conveys the same to the house drain, soil, or waste stacks. When such pipe does not connect directly with a house drain or soil stack, it is termed a special waste.

l. Main. The main of any system of horizontal, vertical or continuous piping is that part of such system which receives the wastes, vent or back vents, from fixture outlets or traps, direct or through branch pipes.

m. Branch. The branch of any system of piping is that part of the system which extends horizontally at a slight grade, with or without lateral or vertical extensions or vertical arms, from the main to receive fixture outlets not directly connected to the main.

n. Stack. Stack is a general term for any vertical line of soil, waste, or vent piping.

o. House Drain. The house drain is that part of the lowest horizontal piping of a house drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of any building and conveys the same to the house sewer beginning 5 feet outside of the inner face of the building wall.

p. House Sewer. The house sewer is that part of the horizontal piping of a house drainage system extending from the house drain 5 feet outside of the inner face of the building wall to its connection with the main sewer or cesspool and conveying the drainage of but one building site.

q. Size and Length. The given caliber or size of pipe is for a nominal internal diameter; except that other than iron pipe size, brass pipe is measured by its outside diameter. The developed length of a pipe is its length along the center line of pipe and fittings.

r. Dead End. A dead end is a branch leading from a soil, waste, vent, house drain, or house sewer, which is terminated at a developed distance of 2 feet or more by means of a cap, plug, or other fitting not used for admitting water to the pipe.

s. Surface Drain. A connection with house drain to allow escape of surface water or overflow is a surface drain.

t. Repair of Leaks. Such repairs as are necessary to protect property, but do not involve any extensive change in construction.

Sec. 3903. Regulations.

a. Grades of Horizontal Piping. All horizontal piping shall be run in practical alignment and at a uniform grade of not less than one-eighth of an inch per foot, and shall be supported or anchored at intervals not to exceed 5 feet for soil pipes and 9 feet for W. I. or steel pipes. All stacks shall be supported at their bases, and all pipes shall be rigidly secured.

b. Change in Direction. All changes in direction shall be made by the appropriate use of 45° wyes, half wyes, long sweep quarter bends, sixth, eighth, or sixteenth bends; except that single sanitary tees may be used on vertical stacks, and short quarter bends may be used in soil and waste lines where the change in direction of flow is from the horizontal to the vertical. Tees and crosses may be used in vent pipes.

c. Prohibited Fittings. No double hub, double T, or double sanitary T branch shall be used on soil or waste lines. The drilling and tapping of house drains, soil, waste, or vent pipes, and the use of saddle hubs and bands are prohibited.

d. Dead Ends. In the installation of any drainage system dead ends shall be avoided.

e. Protection of Material. All pipes passing under or through walls shall be protected from breakage. All pipes passing through or under cinder concrete or other corrosive material shall be protected against external corrosion.

f. Workmanship. Workmanship shall be of such character as fully to secure the results sought to be obtained in all of the sections of this Code.

Sec. 3904. Quality and weights of materials.

a. Materials, Quality of. All materials used in any drainage or plumbing system, or part thereof, shall be free from defects.

b. Label, Cast or Stamped. Each length of pipe, fitting, trap, fixture, and device used in a plumbing or drainage system shall be stamped or indelibly marked with the weight or quality thereof and the maker's mark or name.

c. Vitrified Clay Pipe. All vitrified clay pipe shall conform to the A. S. T. M. "Standard Specifications for Clay Sewer Pipe" (serial designation, C 13-24).

d. Cast-Iron Pipe. 1. Quality:—All cast-iron pipe and fittings shall conform to the A. S. T. M. "Standard Specifications for Cast-Iron Soil Pipe and Fittings" (serial designation, A 74-29).

2. Cast-iron pipes shall be sound, cylindrical, and smooth, free from cracks and other defect, of uniform thickness and of the grade known to commerce as "extra heavy".

3. Coating:—All cast-iron pipe and fittings for underground use shall be coated with asphaltum or coal-tar pitch.

e. Wrought-Iron Pipe. All wrought-iron pipe shall conform to the A. S. T. M. "Standard Specifications for Welded Wrought-Iron Pipe" (serial designation, A 72-33), and shall be galvanized.

f. Mild-Steel Pipe. All steel pipe shall conform to the A. S. T. M. "Standard Specifications for Welded and Seamless Steel Pipe" (serial designation, A 53-33), and shall be galvanized.

g. Brass and Copper Pipe. Brass and copper pipe shall conform, respectively, to the standard specifications of the A. S. T. M. for "Brass Pipe, Standard Sizes," and for "Copper Pipe, Standard Sizes" (serial numbers B 43-33 and B 42-33, respectively). Brass pipe shall contain not less than 66 2/3% of copper.

h. Lead Pipe, Diameter, Weights. 1. All lead pipe shall be of best quality, of drawn pipe, of not less weight per linear foot than shown below.

2. Lead soil, waste, vent, or flush pipes, including bends and traps (extra light):

Internal Diameter	Weights Per Foot		Internal Diameter	Weights Per Foot	
Inches	Lbs.	Ozs.	Inches	Lbs.	Ozs.
1	2	..	2	4	..
1¼	2	8	3	4	12
1½	3	8	4	6	..

3. Lead water-supply pipe above ground (strong):

Internal Diameter	Weights Per Foot		Internal Diameter	Weights Per Foot	
Inches	Lbs.	Ozs.	Inches	Lbs.	Ozs.
½	2	..	1¼	4	12
⅝	2	8	1½	6	..
¾	3	..	1¾	6	8
1	4	..	2	7	..

4. Lead water-supply pipe under ground (extra strong):

Internal Diameter	Weights Per Foot		Internal Diameter	Weights Per Foot	
Inches	Lbs.	Ozs.	Inches	Lbs.	Ozs.
½	2	8	1¼	6	..
⅝	3	..	1½	7	8
¾	3	8	1¾	8	..
1	4	12	2	9	..

i. Sheet Lead. Sheet lead shall weigh not less than 4 pounds per square foot.

j. Sheet Copper or Brass. Sheet copper or brass shall be not lighter than No. 17 B. and S. gauge, except that for local and interior ventilating pipe, it shall be not lighter than No. 23 B. and S. gauge.

k. Galvanized Sheet Iron. Galvanized sheet iron shall be not lighter than the following B. and S. gauge:

No. 26 for 2 to 12 inch pipe.
No. 24 for 13 to 20 inch pipe.
No. 22 for 21 to 26 inch pipe.

l. Threaded Fittings. 1. All threaded pipe fittings shall be recessed.

2. Plain screwed fittings shall be of cast iron, malleable iron, or brass of standard weight and dimensions.

3. Drainage fittings shall be of cast iron, malleable iron, or brass, with smooth interior waterway, with threads tapped out of solid metal.

4. All cast-iron fittings used for water-supply distribution shall be galvanized.

5. All malleable iron fittings shall be galvanized.

m. Calking Ferrules. Brass calking ferrules shall be of the best quality red cast brass, with weights and dimensions in accordance with the following table:

Pipe Size (Inches)	Actual Inside Diameter Inches	Length Inches	Weight	
			Lbs.	Ozs.
2	2¼	4½	1	
3	3¼	4½	1	12
4	4¼	4½	2	8

n. Soldering Nipples and Bushings. 1. Soldering nipples shall be of brass pipe, iron-pipe size, or of heavy, cast red brass not less than the following weights:

Diameters Inches	Weights Ozs.	Diameters Inches	Weights Lbs.	Weights Ozs.
1¼	6	2½	1	6
1½	8	3	2	0
2	14	4	3	8

2. Soldering bushings shall be of brass pipe, iron-pipe size, or of heavy, cast red brass.

o. Floor Flanges for Water-Closets. Floor flanges for water-closets shall be not less than three-sixteenths of an inch thick, and of brass or cast iron.

Sec. 3905. Joints and connections.

a. Water and Air Tight Joints. All joints and connections mentioned under this Part shall be made permanently gas and water-tight.

b. Vitrified Pipe. All joints in vitrified clay pipes, or between vitrified clay pipe and metals, shall be poured joints.

c. Calked Joints. All calked joints shall be firmly packed with oakum or hemp, and shall be secured only with pure lead, not less than 1 inch deep, well calked, and no paint, varnish, or putty will be permitted until after the joint is tested.

d. Screw Joints. All screw joints shall be American standard screw joints, and all burrs or cuttings shall be removed.

e. Cast-Iron. Cast-iron joints may be either calked or screw joints made in the approved manner.

f. Wrought Iron, Steel, or Brass to Cast-Iron. The joints may be either screwed or calked joints made in the approved manner.

g. Lead Pipe. Joints in lead pipe or between lead pipe and brass or copper pipes, ferrules, soldering nipples, bushings, or traps, in all cases on the sewer side of the trap and in concealed joints on the inlet side of the trap, shall be full-wiped joints, with an exposed surface of the solder to each side of the joint of not less than three-quarters of an inch and a minimum thickness at the thickest part of the joint of not less than three-eighths of an inch.

h. Lead to Cast-Iron, or Wrought Iron. The joints shall be made by means of a calking ferrule, soldering nipple, or bushing.

i. Slip Joints and Unions. Slip joints will be permitted only in trap seals or on the inlet side of the trap.

j. Roof Joints. The joint at the roof shall be made water-tight by use of copper, lead, or iron plates or flashings.

k. Closet, Pedestal Urinal and Trap Standard Slop Sink, Floor

Connections. A brass floor connection shall be wiped or soldered to lead pipe, an iron floor connection shall be calked to cast-iron pipe, or an iron floor connection calked or screwed to wrought-iron pipe, and the floor connection bolted to an earthenware trap flange. A metal to earthenware, a metal to metal union or a lead or asbestos gasket or washer shall be used to make a tight joint.

l. Increasers and Reducers. Where different sizes of pipes or pipes and fittings are to be connected, proper size increasers or reducers, pitched at an angle of 45° between the two sizes, shall be used.

m. Prohibited Joints and Connections. Any fitting or connection which has an enlargement, chamber, or recess with a ledge shoulder or reduction of the pipe area in the direction of the flow on the outlet or drain side of any trap is prohibited.

n. Expansion Bolts. Connections of wall hangers, pipe supports, or fixture settings with the masonry, stone, or concrete backing shall be made with expansion bolts without the use of wooden plugs.

o. New Materials. Any other material than that specified in this Code, which the Superintendent approves, in accordance with Section 204, h, may be permitted.

p. Welding of Plumbing Joints and Connections. 1. Joints and connections for water pipe made of brass, copper, black steel or black wrought-iron, or combinations of these materials, may be made by welding or brazing.

2. The welding of any galvanized pipe, cast-iron pipe or of drain, soil or vent pipe of any material is forbidden.

3. The electrodes, welding wire and welding rods used in welding shall meet the requirements of Welding Electrodes, Wires and Rods. Welding shall be performed in accordance with the American Bureau of Welding Specifications, 1933. Contractors desiring to use welding shall be required to satisfy the Superintendent as to their ability to produce satisfactory joints and connections.

Sec. 3906. Traps and clean outs.

a. Traps, Kind, and Minimum Size. 1. Every trap shall be self-cleaning. Traps for bathtubs, lavatories, sinks, and other similar fixtures shall be of lead or brass.

2. The minimum size (nominal inside diameter) of trap and

waste branch for a given fixture shall not be less than that known in the following table:

Kind of Fixture	Size (in inches), trap and branch
Bathtubs	1½
Bath, shower, stall	2
Bath, sitz	1½
Bath, foot	1½
Bidets	1½
Combination fixture	1½
Drinking fountains	1½
Fountain cuspidors	1½
Floor drains	2
Laundry trays	1½
Sinks, kitchen, residence	1½
Sinks, hotel or public	2
Sinks, large hotel or public	2
Sinks, small, pantry or bar	1½
Sinks, dishwasher	1½
Sinks, slop, with trap combined	3
Sinks, slop sink, ordinary	2
Urinals, lip	1½
Urinals, troughs	2
Urinals, pedestal	3
Urinals, stall	2
Washbasin	1½
Water-closet	3

b. Traps, Prohibited. 1. Except water-closets, all traps not provided with special air pipes, shall be suitable non-syphon traps.

2. When a fixture is so located as to be practically immune from atmospheric action and the installation of a special air pipe would involve architectural difficulty and unreasonable expense, the air pipe may be omitted in the discretion of the Superintendent and only with his express permission. The Superintendent shall be sole judge to the conditions and the method of installation.

c. Traps, Where Required. Each fixture shall be separately trapped by a water-seal trap faced as near to the fixture as possible, except that a set of not more than 3 laundry trays or lavatories or a set of 2 laundry trays and 1 sink may connect with a single trap, provided the trap is placed centrally and the branches connect into the trap seal at an angle of not more than 60° to the vertical arm. In no case shall the waste from bathtub or other fixture discharge into a water-closet trap. No fixture shall be double trapped.

d. Water Seal. Each fixture trap shall have a water seal of not less than 2 inches and not more than 4 inches.

e. Trap Clean Outs. Each trap, except those in combination with fixtures in which the trap seal is plainly visible and accessible, shall be provided with an accessible brass trap screw of ample size, protected by the water seal.

f. Trap Levels and Protection. All traps shall be set true with respect to their water seals and protected from frost and evaporation.

g. Pipe Clean Outs. The bodies of clean-out ferrules shall be made of standard pipe sizes, conform in thickness to that required for pipe and fittings of the same metal, and extend not less than one-quarter inch above the hub. The clean-out cap or plug shall be of heavy red brass not less than one-eighth inch thick and be provided with raised nut or recessed socket for removal.

h. Pipe Clean Outs—Where Required. A clean out easily accessible shall be provided at the foot of each vertical waste or soil stack. There shall be at least two clean outs in the house drain—one at or near the base of the stack and the other, with full-size Y branch, inside the wall near the connection between the house drain and house sewer. Except for the latter, clean outs shall be of the same nominal size as the pipes up to 4 inches and not less than 4 inches for larger pipes. The distance between clean outs in horizontal soil lines shall not exceed 50 feet.

i. Manholes. All underground traps and clean outs of a building, except where clean outs are flush with the floor, and all exterior underground traps shall be made accessible by manholes with proper covers.

j. Clean Outs—Equivalents. Any floor or wall connection of fixture traps when bolted or screwed to the floor or wall shall be regarded as a clean out.

k. Grease Traps. 1. (See also Department of Public Safety regulations.) Every building from which, in the opinion of the Superintendent, grease may be discharged in such quantity as to injure the sewer, shall have a special grease trap, satisfactory to the Superintendent. Grease interceptors (commonly called grease traps) shall be installed on the wastes from all pot or dishwashing sinks or machines in every hotel, restaurant or lunch room kitchen, pantry or serving room. If a trap is built into or is a part of the interceptor, a concealed cast partition shall not be used to divide the legs of the trap, and any clean out must be below the trap seal. Such grease interceptors shall be of ample capacity to separate 95% of the grease from the flowing waste according to the size of the connected waste lines, and such interceptor or trap thereto must provide for a continuous evacuation of heavy foreign matter during flow of waste.

2. Grease, plaster, hair or lint interceptors must be approved as to type and size by the Superintendent.

l. Special Traps. Every building in which gasoline, naphtha, or other inflammable compounds are used for business purposes shall be provided with a special trap, satisfactory to the Superintendent, so designed as to prevent the passage of such material into the sewer, and ventilated with a separate pipe rising to a point 4 ft. above the roof. The waste pipe of every washstand for vehicles shall be provided with a sand box of sufficient capacity.

m. Basement Floor Drains. Cellar or basement floor drains shall connect into a trap so constructed that it can be readily cleaned and of a size to serve efficiently the purpose for which it is intended. The drain inlet shall be so located that it is at all times in full view. When subject to back flow or back pressure, such drains shall be equipped with an adequate back-water valve.

n. Back-Water Valves. Back-water valves shall have all bearing parts or balls of non corrodible metal and so constructed as to insure a positive mechanical seal and remain closed except when discharging wastes.

o. Non-Siphon Traps. Except for water-closets, all traps not provided with special air pipes shall be suitable non-siphon traps. Round traps shall be not less than 4 in. in diameter and, if of lead, shall be 8 in. long and made of 8 lb. lead. All trap screws shall be watersealed.

Sec. 3907. Water supply and distribution.

a. Quality of Water. The quality of the water supply shall meet accepted standards of purity.

b. Distribution. The water supply shall be distributed through a piping system entirely independent of any piping system conveying another water supply.

c. Water Service. The water-service pipe of any building shall be of sufficient size to permit a continuous ample flow of water on all floors at a given time.

d. Water Supply to Fixtures. 1. All plumbing fixtures shall be provided with a sufficient supply of water for flushing to keep them in a sanitary condition. Every water-closet or pedestal urinal shall be flushed by means of an approved tank or flush valve of at least 4 gallons flushing capacity for water-closets and at least 2 gallons for urinals, and shall be adjusted to prevent the waste of water. The flush pipe for water-closet flush tanks shall be not less than 1¼ inches in diameter, and the water from flush tanks shall be used for no other purpose.

2. No water-closet or urinal bowl shall be supplied directly from a water-supply system through a flushometer or other valve unless such valve is set above the water-closet or urinal in a manner such as to prevent any possibility of polluting the water supply.

3. No plumbing fixture, device, or construction shall be installed which will provide a cross connection between a distributing system of water for drinking and domestic purposes and a drainage system, soil, or waste pipe so as to permit or make possible the back flow of sewage or waste into the water-supply system.

e. Size of Water Supply Pipes. The minimum size of water-service pipes from the curb to the dwelling shall be one-half inch, and to fixtures as follows:

	Inch		*Inch*
Sill cocks	½	Lavatories	⅜
Hot-water boilers	½	Bathtubs	½
Laundry trays	½	Water-closet tanks	⅜
Sinks	½		

f. Water Supply Pipes and Fittings—Material. All water-supply pipes for a plumbing system shall be of lead, galvanized wrought iron or steel, brass, or cast iron, with brass or galvanized cast-iron or galvanized malleable-iron fittings. No pipe or fittings that have been used for other purposes shall be used for distributing water.

g. Water Supply Control. A main shut-off on the water-supply line shall be provided near the curb. Accessible shut-offs shall be provided on the main supply line just inside the foundation wall for each flat or apartment of a building, for each lawn sprinkler, for supply to each hot water tank, and for each water-closet.

h. Water Supply, Protection. All concealed water pipes, storage tanks, flushing cisterns, and all exposed pipes or tanks subject to freezing temperatures shall be efficiently protected against freezing.

i. Pumps and Hydrants. All pumps and hydrants shall be protected from surface water and contamination. Drips must not be connected to the sewer.

j. Hot Water Supply Systems. 1. No tank or vessel in which water is heated under pressure shall be installed unless it complies with Sections 17, 18, 19, and 20 of Chapter 142 of the General Laws of the State of Massachusetts.

2. Where hot water supply systems are installed, the hot water riser shall be covered with approved insulating material unless the hot water and cold water risers are 6 inches or more apart. All hot water and hot water circulating piping should be so graded as

to eliminate air pockets from the system. This assures good gravity circulation and prompt supply of hot water at the fixtures directly the faucets are opened, thus saving both water and fuel.

k. Relief Valves and Safety Devices. 1. *Vacuum Valve.* Every tank in which water is heated under pressure shall be equipped with an approved type of vacuum valve, located in the cold water piping to the tank, at a point above the tank, and not more than a foot (12″) from the tank.

2. *Relief Valve.* Every hot water tank installed hereafter and all hot water tanks replaced, repaired, or relocated and every hot water tank in which a water heating device or appliance is attached shall be equipped with a suitable pressure relief valve satisfactory to the Superintendent.

3. *Temperature Control.* Every tank shall be equipped with a proper self-contained and automatic means of approved type which will effectively prevent the temperature of at least one-half the water in the tank from exceeding a temperature of 212° F.

4. *Installation of Temperature Control.* A means, device or valve used to prevent the temperature of the water in the tank from exceeding 212° F. shall be so connected to the tank that the water in the tank, when in service, shall be at all times in direct contact with the temperature-operated element contained in the control.

5. *Temperature Controlling Devices.* A temperature controlling means of the fusible plug type shall be connected directly in the tank, and not more than six inches (6″) above or below the center, between the top and bottom, whether the tank is vertical or horizontal.

6. *Temperature Control Means.* Every water heater using hard fuel, such as coal, coke, charcoal, wood, etc., attached to any tank, shall be equipped with an approved means which will prevent the temperature of the water delivered from the heater from exceeding 212° F.

7. *Circulating Pipes.* Every water heater connected to a tank shall be provided with circulating pipes, between the heater and tank, of sufficient size to readily pass the entire volume of water in the tank, in one hour under gravity circulation, (water fronts excepted).

8. *Size of Circulating Pipes.* All pipes and fittings 2½″ and under, in the circulating system, between the heater and tank shall be seamless drawn brass or copper in strength and capacity of iron size pipe.

RECOMMENDED SCHEDULES

Size of Tank	*Size of Circulating Pipe*
30 to 40 gals.	¾″ I. S. Pipe
50 to 60 gals.	1″ I. S. Pipe
80 to 150 gals.	1 ¼″ I. S. Pipe
200 to 250 gals.	1 ¼″ I. S. Pipe
300-400-500 gals.	1 ½″ I. S. Pipe
600-700-800 gals.	2″ I. S. Pipe
1000 gals.	3″ I. S. Pipe

9. All installations of water tanks, heaters, and water heating devices not mentioned above shall be made only on approval of the Superintendent.

10. *Blow-Off Piping.* All blow-off piping from safety valves shall be non-ferrous brass or copper, and shall be full size of outlet tapping of valve, and shall discharge into open fixture properly trapped and vented.

l. Boiler Feed. 1. Heating or power boilers or other pressure vessels taking their supply from the house piping shall be supplied through an approved automatic water feed device or pump with a check valve.

2. Power pumps for this purpose shall not be so connected that they pump directly from a city main or the building supply but through an open surge tank controlled by a balanced ball cock.

m. House Supply Tanks Required. When the water pressure is insufficient to supply all fixtures freely and continuously, a house supply tank shall be provided adequate to supply all fixtures amply and at all times.

n. Supply of House Tanks. Such tanks shall be supplied from the street pressure or, when necessary, by power pumps, when from the street pressure, balanced ball cocks shall be provided.

o. Design of House Supply Tanks. Gravity house supply tanks shall be built of wood, steel or copper, or of wood lined with tinned and planished copper and be supported on steel beams. They shall be provided with suitable covers.

p. Overflow Pipes for House Supply Tanks. Overflow pipes for gravity tanks shall discharge, when possible, above and within 6 inches of the roof, otherwise they shall be trapped and discharged over an open water supplied sink 3½ feet or less above the floor. Connection of overflow pipes with any part of the plumbing (except as above provided) is prohibited. Overflow pipes shall be at least one commercial size larger than the supply pipe, with a minimum of 4 inches for tanks, the capacity of which is 500 gallons or over.

q. Emptying Pipes for House Supply Tanks. Emptying pipes must be provided and discharged as required for overflow pipes as in Overflow Pipes for House Supply Tanks. Emptying pipes for tanks containing more than 500 gallons shall be 4 inches in diameter and provided with valves of the same size.

r. Air Chambers. Self-closing devices shall be provided with air chambers or shock absorbers complying with the rules of the Superintendent. Air chambers, if used, must be accessible for recharging and shall have stop, drain and air valve.

Sec. 3908. Plumbing fixtures.

a. Materials. All receptacles used as water-closets, urinals, or otherwise for the disposal of human excreta, shall be vitrified earthenware, hard natural stone, or cast iron white enameled on the inside.

b. How Installed. All plumbing fixtures shall be installed free and open in a manner to afford access for cleaning. Where practical all pipes from fixtures shall be run to the wall, and no lead trap or pipe shall extend nearer to the floor than 12 inches unless protected by casing.

c. Water-Closet Bowls. Water-closet bowls and traps shall be made in one piece and of such form as to hold sufficient quantity of water, when filled to the trap overflow, to prevent fouling of surfaces, and shall be provided with integral flushing rims constructed so as to flush the entire interior of the bowl.

d. Frost-Proof Closets—Where Permitted. Frost-proof closets may be installed only in compartments which have no direct connection with a building used for human habitation or occupancy. The soil pipe between the hopper and the trap shall be 3 inches in diameter and shall be of lead, or cast iron enameled on the inside.

e. Fixtures Prohibited. Fixed wooden wash trays or sinks shall not be installed in any building designed or used for human habitation. No new copper lined wooden bathtubs shall be installed, and an old fixture of this class taken out shall not be reconnected. Pan and valve plunger, offset washout and other water-closets having invisible seals or unventilated space, or walls not thoroughly washed at each flush shall not be used. Long hopper closets or similar appliances shall not hereafter be installed. No dry closet or chemical closet shall be installed in a dwelling.

f. Floor Drains and Shower Drains. A floor drain or a shower drain shall be considered a fixture and provided with a strainer.

g. Fixture Strainers. All fixtures other than water-closets and pedestal urinals shall be provided with fixed strong metallic strainers with outlet areas not less than that of the interior of the trap and waste pipe.

h. Fixture Overflow. The overflow pipe from a fixture shall be connected on the house or inlet side of the trap and be so arranged that it may be readily and effectively cleaned.

i. Replacement and Alterations in Plumbing Systems. A plumbing system legally installed prior to the time this Code is adopted may be either replaced or altered to any extent involving 50 per cent or less of the number of fixture units in the system without being brought into compliance with this Code provided the system is repaired or altered in a safe and sanitary manner, but if any replacements or alterations involve more than 50% of the fixture units in the system, the whole system shall be made to comply with this Code (except that any one fixture may be replaced with another of similar capacity and purpose without regard to the preceding limitations of this section).

j. Flush Tank Lining. The lining of water-closet and urinal flush tanks, if of copper, shall be of at least 12 ounce copper.

k. Flush Pipe Sizes. Water-closet flush pipes shall be at least 1¼ inches and urinal flush pipes at least 1 inch in diameter, and may be of copper tubing at least 0.0313 inches in thickness (No. 22 United States gauge).

l. Construction of Swimming Pools. Pools shall be built water tight and the inside surface shall be made of a smooth, non-absorbent material with rounded corners and so constructed as to be easily kept cleaned.

m. Drainage of Swimming Pools. 1. Pool should be provided with a group of drain outlets, say three or four, depending on its area, so as to equalize its outflow; also, an overflow at the high water line. The drains should be trapped and vented before connecting with the drainage system. The overflow shall be connected to the inlet side of the trap. The spaces around the pool shall be drained in such a manner that water will not drain into the pool. Such spaces may pitch into drained gutters built into the sides of the pool. The drain in the gutters may also serve as overflows.

2. The size of the drain and vent connections shall be determined by the capacity of the pool when filled to the overflow level. Each 1,000 gallons of capacity shall be considered one fixture unit.

3. The diameter of the trap shall be at least the diameter of the drain pipe.

n. Circulation of Water in Swimming Pools. 1. Pools shall be equipped to provide a continuous supply of clear wholesome water at the rate of twenty gallons per hour for each bather using the pool in any one hour. The supply may be either fresh water from an approved water-supply system or may be recirculated if approved means are provided for filtering and sterilizing the water before it is reintroduced into the pool. The inlets shall be located so as to circulate the water over the entire area of the pool.

2. The piping of recirculating systems shall be kept entirely separate from the city or domestic supply system, which must have no physical connection therewith. The supply pipe shall discharge into the pool above the rim thereof.

o. Sterilizing and Filtration Equipment for Swimming Pools. Sterilizing and filtration equipment shall be adequate to keep the pool in a sanitary condition at all times. Filters must be indirectly connected to sewer and be provided with air break on the supply.

p. Shower Baths and Toilet Facilities. Adequate shower bath and toilet accommodations, conveniently located for the use of the bathers, shall be provided for all pools.

q. Baptistries, Ornamental and Lily Pools, Aquaria, Ornamental Fountain Basins and Similar Constructions shall have the supplies thereto protected from siphonage or gravity drainage cross-connections by means of suitable air-break devices placed on the supply above the overflow level of the fixture.

r. Number of Toilet Fixtures Required. 1. Every public building shall comply with the Massachusetts Department of Public Safety with regard to the number of water-closets and urinals required.

2. Within every dwelling apartment, there shall be a water-

closet. Additional requirements shall be as described under Parts VI to XV inclusive.

3. There shall be at least one lavatory wherever water-closets are required.

s. Fixtures in Cellar. Drain pipes from fixtures in cellars and basement liable to back flow from a sewer shall be supplied with back water valves.

t. Fixtures in Chemical Laboratories, Stables. 1. Fixtures and waste pipes in chemical laboratories shall be installed in accordance with plans approved by the Superintendent.

2. The drainage of stable fixtures shall be constructed in accordance with plans approved by the Superintendent.

Sec. 3909. Hangers and supports for plumbing piping.

a. Vertical Piping. Vertical piping shall be securely supported at the base and at maximum intervals of twenty (20) feet.

b. Horizontal Piping. Horizontal piping shall be securely supported at maximum intervals of 5 feet for soil pipes and 9 feet for W. I. and steel pipes by clamps to the woodwork, iron drive hooks to brick walls, bolted clamps to steel beams, or supported on masonry.

c. Hangers. Hangers shall be metal of heavy pattern and shall be securely attached to the building construction.

d. Bases of Risers and Horizontal Runs. Bases of risers and horizontal runs in cellars must be supported on substantial masonry piers.

e. Pipes Underground. Pipes in filled ground shall be supported on concrete or cement laid brick or stone piers every 5 feet.

Sec. 3910. Ventilation of rooms and fixtures.

a. Location of Fixtures. No trapped plumbing fixtures shall be located in any room or apartment which does not contain a window placed in an external wall or is not otherwise provided with proper ventilation.

b. Ventilating Pipe, How Connected. Ventilation pipes from fixtures and toilet rooms shall be separate and distinct and have no connection whatever with the other ventilating ducts or pipes in the building.

Sec. 3911. Soil, waste, and vent pipes.

a. Material. All main or branch soil, waste, and vent pipes within the building shall be of cast iron, galvanized steel or galvanized wrought iron. Short connections may be of lead, brass, or copper, except that no galvanized steel or wrought iron pipe shall be used for underground soil or waste pipes.

b. Fixture Unit. 1. The following table, based on the rate of discharge from a lavatory as the unit, shall be employed to determine fixture equivalents:

	Fixture units
One lavatory or wash basin	1
One kitchen sink	1½
One bathtub	2
One laundry tray	3
One combination fixture	3
One urinal	3
One shower bath	3
One floor drain	3
One slop sink	4
One water-closet	6
One bathroom group consisting of 1 water-closet, 1 lavatory, and 1 bathtub and overhead shower; or of 1 water-closet, 1 lavatory, and 1 shower compartment	8

2. One hundred and eighty square feet of roof or drained area in horizontal projection shall count as one fixture unit.

c. Soil and Waste Stacks. Every building in which plumbing fixtures are installed shall have a soil or waste stack, or stacks, extending full size through the roof. Soil and waste stacks shall be as direct as possible and free from sharp bends and turns. The required size of a soil or waste stack shall be determined from the distribution and total of all fixture units connected to the stack in accordance with the following table, provided, that, with the approval of the Superintendent, a 3-in. soil pipe may be used for one water-closet where it is not practicable to use a 4-in. pipe.

MAXIMUM FIXTURE UNITS ON ONE STACK.

Diameter (inches)	With "sanitary T" inlets		With all 45° Y or "combination Y and one-eighth bend" inlets		Maximum length, including extension as vent Feet
	In one branch interval[1]	On any one stack	In one branch interval[1]	On any one stack	
1¼	1	1	1	1	50
1½	2	8	4	12	65
2	9	16	15	36	85
3	24	48	45	72	212
4	144	256	240	384	300
5	324	680	540	1,020	390
6	672	1,380	1,122	2,070	510
8	2,088	3,600	3,480	5,400	750

[1] The term "branch interval" shall be interpreted to mean a vertical length of stack, not less than 8 feet, within which a branch or branches are connected, and the total fixture units on all branches connected to a stack within any 8-foot length shall not exceed the maximum permitted by the table in one "branch interval."

d. Soil and Waste Stacks, Fixture Connections. 1. All soil and waste stacks and branches shall be provided with correctly faced inlets for fixture connections. In buildings where a series of bathrooms or kitchens are located directly over each other and have a common soil or waste pipe, the branch vents in each story shall connect to the vent line above the top of the highest fixture on each floor and the vent line shall connect to the ventilation pipe or to the extension of the waste pipe above the highest fixture in the building.

2. In the case of batteries of water-closets or other fixtures, the special air pipe from each trap may be omitted, provided the soil or waste pipe, undiminished in size, is continued from the farthest fixture through the roof or is looped into the ventilation pipe or to the extension of the waste pipe above the highest fixture in the building.

e. Changing Soil and Vent Pipes. In existing buildings where the soil or waste vent pipe is not extended undiminished through or above the roof, or where there is a sheet-metal soil or waste vent pipe, and the fixture is changed in style or location or is replaced, a soil or waste vent pipe of the size and material prescribed for new work shall be installed.

f. Refrigerator Wastes. Refrigerator waste-pipes shall be not less than 1¼ in. for 1 opening, 1½ inches for 3 openings, and for 4 to 12 openings must be not less than 2 inches, and shall have at each opening a trap, and clean-out at angles, so arranged as properly to flush and clean pipe. Such waste pipes shall be continued not less than full size through the roof, except where such fixtures are located in the basement or first floor.

g. Prohibited Connections. No fixture connection shall be made to a lead bend or branch of a water-closet or similar fixture. No soil or waste vent, circuit or loop vent above the highest installed fixture on the branch or main shall thereafter be used as a soil or waste pipe.

h. Soil and Waste Pipe Protected. No soil or waste stack shall be installed or permitted outside a building unless adequate provision is made to protect it from frost.

i. Roof Extensions. 1. Every house drain shall be extended as a soil and ventilation pipe through the roof undiminished in size, and to a height not less than 2 ft. above the roof and not less than 1 ft. above the top of any window within 15 ft. and not less than 8 ft. above the roof if the roof is used for drying clothes or as a roof garden.

2. When there is danger of frost closure, no roof extension shall be less than 4 inches in diameter. Change in diameter shall be made by use of a long increaser at least 1 foot below the roof, and, where access to the roof is difficult, a test opening shall be provided at this point.

j. Terminals Adjoining High Buildings. 1. No soil, waste, or vent pipe extension of any new or existing building shall be run or placed on the outside of a wall, but shall be carried up in the inside of the roof.

2. In the event that a new building is built higher than an adjoining existing building, the owner of the new building shall not locate windows within 12 feet of any existing vent stack on the lower building unless the owner of such new building shall defray

the expenses or shall himself make such alteration as to conform with paragraph i of this section.

3. It shall be the duty of the owner of the lower or existing building to make such alteration therein upon the receipt in advance of money or security therefor, sufficient for the purpose, from the owner of the new or higher building or to permit, at the election of the owner of the new or higher building, the making of such alteration by the owner of said new or higher building.

k. Traps Protected, Vents. Except as otherwise provided, traps shall be protected from siphonage or air pressure by special iron or brass air pipes of a size not less than the waste pipes they serve; back air pipes shall not be connected to the trap or branched into the waste pipe, except where a continuous vent is not practicable, but a suitable non-siphon trap may be used without a back air pipe upon the approval of the Superintendent. Back air pipes shall enter the waste pipe within 18 in. from the trap and shall be a continuation of the waste pipe. Lead air pipes may be used only for short connections, where they are exposed to view. Air pipes for water-closet traps shall be connected to the highest point of bend. No crown vent shall be installed.

l. Distance of Vent from Trap Seal. No trap shall be placed more than 5 feet, horizontal developed length, from its vent. The distance shall be measured along the central line of the waste or soil pipe from the vertical inlet of the trap to the vent opening. The vent opening from the soil or waste pipe, except for water-closets and similar fixtures, shall not be below the dip of the trap.

m. Main Vents to Connect at Base. All main vents or vent stacks shall connect full size at their base to the main soil or waste pipe at or below the lowest fixture branch and shall extend undiminished in size above the roof or shall be reconnected with the main soil or waste vent at least 3 feet above the highest fixture branch.

n. Vents, Required Sizes. The required size of main vents or vent stacks shall be determined from the size of the soil or waste stack vented, the total number of fixture units drained into it, and the developed length of the vent, in accordance with the following table, interpolating when necessary between permissible lengths of vent given in the table:

MAXIMUM PERMISSIBLE LENGTH OF VENTS (IN FEET) FOR SOIL AND WASTE STACKS.

Diameters of soil or waste stack (in.)	No. of fixture units	Diameter of vent (in inches)									
		1¼	1½	2	2½	3	4	5	6	8	10
1¼	1	45	..	...	...	...	...	...	...	...	...
1½	Up to 8	35	60	...	...	...	...	...	...	...	...
2	Up to 18	30	50	90	...	...	...	...	...	...	...
2½	Up to 36	25	45	75	105	...	...	...	...	...	...
3	12	..	34	120	180	212	...	...	...	...	...
3	18	..	18	70	180	212	...	...	...	...	...
3	24	..	12	50	130	212	...	...	...	...	...
3	36	..	8	35	93	212	...	...	...	...	...
3	48	..	7	32	80	212	...	...	...	...	...
3	72	..	6	25	65	212	...	...	...	...	...
4	24	..	..	25	110	200	300	340	...	...	...
4	48	..	..	16	65	115	300	340	...	...	...
4	96	..	..	12	45	84	300	340	...	...	...
4	144	..	..	9	36	72	300	340	...	...	...
4	192	..	..	8	30	64	282	340	...	...	...
4	264	..	..	7	20	56	245	340	...	...	...
4	384	..	..	5	18	47	206	340	...	...	...
5	72	..	..	..	40	65	250	390	440	...	...
5	144	..	..	..	30	47	180	390	440	...	...
5	288	..	..	..	20	32	124	390	440	...	...
5	432	..	..	..	16	24	94	320	440	...	...
5	720	..	..	..	10	16	70	225	440	...	...
5	1,020	..	..	..	8	13	58	180	440	...	...
6	144	..	..	..	..	27	108	340	510	...	...
6	288	..	..	..	..	15	70	220	510	630	...
6	576	..	..	..	..	10	43	150	425	630	...
6	864	..	..	..	..	7	33	125	320	630	...
6	1,296	..	..	..	..	6	25	92	240	630	...
6	2,070	..	..	..	..	4	21	75	186	630	...
8	320	..	..	..	..	..	42	144	400	750	900
8	640	..	..	..	..	..	30	86	260	750	900
8	960	..	..	..	..	..	22	60	190	750	900
8	1,600	..	..	..	..	..	16	40	120	525	900
8	2,500	..	..	..	..	..	12	28	90	370	900
8	4,160	..	..	..	..	..	7	22	62	252	840
8	5,400	..	..	..	..	..	5	17	52	212	705

o. Branch and Individual Vents. No vents shall be less than 1¼ inches in diameter. For 1¼ and 1½ inch wastes the vent shall be of the same diameter as the waste pipe, and in no case shall a branch or main vent have a diameter less than one-half that of the soil or waste pipe served, and in no case shall the length of a branch vent of given diameter exceed the maximum length permitted for the main vent serving the same size soil or vent stack.

p. Vent Pipe Grades and Connections. All vent and branch vent pipes shall be free from drops or sags and be so graded and connected as to drip back to the soil or waste pipe by gravity. Where vent pipes connect to a horizontal soil or waste pipe, the vent branch shall be taken off above the center line of the pipe, and the vent pipe must rise vertically or at an angle of 45° to the vertical to a point 6 inches above the fixture it is venting before offsetting horizontally or connecting to the branch, main waste, or soil vent.

q. Circuit and Loop Vents. A circuit or loop vent will be permitted as follows: A branch soil or waste pipe to which two and not more than eight water-closets, pedestal urinals, trap standard slop sinks, or shower stalls are connected in the series may be vented by a circuit or loop vent, which shall be taken off in front of the last fixture connection. Where fixtures discharge above such branch, each branch shall be provided with a relief one-half the diameter of the soil or waste stack, taken off in front of the first fixture connection.

r. Vents Not Required. 1. No vents will be required on a down spout or rain leader trap, a back-water trap, a subsoil catch basin trap, or on a cellar floor drain, provided the cellar floor drain branches into the house drain on the sewer side at a distance of 5 feet or more from the base of the stack.

2. Where bathrooms or water-closets or other fixtures are located on opposite sides of a wall or partition or directly adjacent to each other within the prescribed distance, such fixtures may have a common soil or waste pipe and common vent.

Sec. 3912. House drains and sewers.

a. Independent Systems. The drainage and plumbing system of each new building and new work installed in an existing building shall be separate from and independent of that of any other building, except as provided below, and every building shall have an independent connection with a public or private sewer when available.

Exception—Where one building stands in the rear of another building on an interior lot and no private sewer is available or can be constructed to the rear building through adjoining alley, court, yard, or driveway, the house drain from the front building may be extended to the rear building and the whole will be considered as one house drain.

b. Old House Sewers and Drains. Old house sewers and drains may be used in connection with buildings or new plumbing only when they are found, on examination and test, to conform in all respects to the requirements governing new sewers or drains, as prescribed in this Code. If the old work is found defective, the Superintendent shall notify the owner to make the necessary changes to conform with this Code.

c. Connections with Cesspools. When a sewer is not available, drain pipes from buildings shall be connected with approved private sewage disposal works acceptable to the Superintendent.

d. Excavations. 1. Each system of piping shall be laid in a separate trench, provided that drainage trenches may be benched not less than 18 inches for lighter piping, if not in violation of any city regulation prescribed for their installation. Where a double system of drainage is installed, the sanitary and surface house sewers or drains may be laid side by side in one trench.

2. Tunnelling for distances not greater than 6 feet is permissible in yards, courts, or driveways of any building site. When pipes are driven, the drive pipe shall be at least one size larger than pipe to be laid.

3. All excavations required to be made for the installation of a house-drainage system, or any part thereof within the walls of a building, shall be open trench work. All such trenches and tunnels shall be kept open until the piping has been inspected, tested, and approved.

e. House Drains Underground. Whenever possible all house drains shall be brought into the building below the basement or cellar floor.

f. Material. 1. The house sewer beginning 10 feet outside of the inner face of the building wall shall be of extra heavy cast iron.

2. The house drain when underground shall be of lead, brass, or extra heavy cast iron.

3. The house drain, if above ground shall be made of extra heavy cast iron, galvanized wrought iron or standard weight, or brass pipe of not less than No. 13 Stubbs gauge within the building except that lead pipes may be used for short connections exposed to view; provided, that no house sewer, or house drain shall be of wrought iron or steel.

g. Depth of Drains and Sewers. No house sewer or underground house drain shall be laid parallel to or within 3 feet of any bearing wall, which might be thereby weakened. The house sewer and drains shall be laid at sufficient depth to protect them from frost.

h. Size of Drains, Sewers, and Horizontal Branches. 1. The required size of sanitary house drains, sanitary house sewers, and horizontal branches shall be determined on the basis of the total number of fixture units drained by them in accordance with the following table:

SANITARY SYSTEM ONLY.

Diameter of Pipe (in.)	Maximum No. of fixture units		
	Slope ⅛ in. fall to 1 foot	Slope ¼ in. fall to 1 foot	Slope ½ in. fall to 1 foot
1½	2	2	3
2	5	6*	8*
3	15**	18**	21**
4	84	96	114
5	162	216	264
6	300	450	600
8	990	1,392	2,220
10	1,800	2,520	3,900
12	3,084	4,320	6,912

*No water-closet shall discharge into a drainpipe less than 3 inches in diameter.

**Not more than two water-closets shall discharge into any 3-inch horizontal branch, house drain, or house sewer.

2. The required sizes of storm-water house drains and house sewers and other lateral storm drains shall be determined on the basis of the total drained area in horizontal projection in accordance with the following table:

STORM SYSTEMS ONLY.

Diameter of Pipe (in.)	Maximum drained roof area (sq. ft.)*			Diameter of Pipe (in.)	Maximum drained roof area (sq. ft.)*		
	Slope ⅛ in. fall to 1 foot	Slope ¼ in. fall to 1 foot	Slope ½ in. fall to 1 foot		Slope ⅛ in. fall to 1 foot	Slope ¼ in. fall to 1 foot	Slope ½ in. fall to 1 foot
3	865	1,230	1,825	8	11,115	15,745	24,890
4	1,860	2,610	4,170	10	19,530	27,575	43,625
5	3,325	4,715	7,465	12	31,200	44,115	69,720
6	5,315	7,515	11,875	14	42,600	60,000	95,000

*The calculations in this table are based on a rate of rainfall of 4 inches per hour.

i. House Sewer in Made Ground. The house sewer when laid in made or filled in ground shall be of vitrified clay pipe, laid on bed of approved grillage or concrete, or of cast-iron pipe, A.S.T.M. approved standards.

j. Drainage Below Sewer Level. In all buildings in which the whole or part of the house drainage and plumbing system thereof lies below the crown level of the main sewer, sewage or house wastes shall be lifted by approved artificial means and discharged into the house sewer.

k. Sumps and Receiving Tanks. All subhouse drains shall discharge into an air-tight sump or receiving tank so located as to receive the sewage by gravity, from which sump or receiving tank the sewage shall be lifted and discharged into the house sewer by pumps, ejectors, or any equally efficient method. Such sumps shall be either automatically discharged or be of sufficient capacity to receive the house sewage and wastes for not less than 24 hours.

l. Ejectors, Vented. The soil or vent pipe leading to an ejector or other appliance for raising sewage or other waste matter to the street sewer shall, where a water-closet or closets are installed, be provided with a vent pipe not less than 4 inches in diameter, and where fixtures other than water-closets are installed, the waste vent pipe shall be the same diameter as the waste pipe.

m. Motors, Compressors, etc. All motors, air compressors, and air tanks shall be located where they are open for inspection and repair at all times. The air tanks shall be so proportioned as to be of equal cubical capacity to the ejectors connected therewith, in which there shall be maintained an air pressure of not less than 2 pounds for each foot of height the sewage is to be raised.

n. Ejectors for Subsoil Drainage. When subsoil catch basins are installed below the sewer level, automatic water ejectors provided with a ball float attached to the main water supply shall be used. Such ejectors or any device raising subsoil water shall discharge into a properly trapped fixture or into a storm-water drain.

o. Change in Direction. Changes in direction shall be made with curved pipes, and all connections with horizontal or vertical pipes shall be made with Y-branches. Saddle hubs shall not be used. All house drain pipes shall be exposed to sight within the building if such exposure is practicable, and shall not be exposed to pressure where they pass through the wall.

Sec. 3913. Storm-water drains.

a. Rain-Water Leaders, General. Rain-water leaders shall not be connected to soil and waste pipe at any point above the basement or cellar ceiling. Wherever a surface drain is installed in a cellar or basement, it shall be provided with a deep seal trap and back-water valve.

b. Drainage of Yards, Areas, and Roofs. 1. All roofs and paved areas, yards, courts, and courtyards shall be drained into the storm-water sewerage system if such exist on the street. If a storm-water sewerage system does not exist the owner may connect the roof and surface drain either to the sanitary sewer or to a dry well. Connection to the sanitary sewer shall be made 10′-0″ out from the building line and a running trap shall be provided on the roof or surface drain line before entering sanitary sewer. When drains used for this purpose are connected with the combined sewerage systems, they shall be effectually trapped, except roof leaders and conductors, where the roof or gutter opening is located not less than 12 feet from a door, window, scuttle, or air shaft. One trap may serve for all such connections, but traps must be set below the frost line or on the inside of the building.

2. When the roof or surface drain is connected to the storm-water sewage, a running trap shall be provided, and located 10 ft. from the building line.

c. Size of Gutters and Leaders. 1. No gutter or inside leader shall be of less size than the following:

Area of roof (in sq. feet)	Gutter Inches	Leader Inches
Up to 90	3	1½
91 to 270	4	2
271 to 810	4	3
811 to 1,800	5	3
1,801 to 3,600	6	4
3,601 to 5,500	8	5
5,501 to 9,600	10	6

2. Outside leaders to the frost line shall be one size larger than required in the above table.

3. Gutters 8 inches or over in width on new buildings shall be hung with wrought-iron hangers of approved type.

4. The above sizes of rain leaders are based on diameter of circular rain leaders, and gutters based on semicircular sheet-metal gutters with the top dimension given and other shapes shall have the same sectional area.

d. Inside Conductors. When placed within the walls of any building or run in an inner or interior court or ventilating pipe shaft, all conductors or roof leaders shall be constructed of cast iron, of galvanized wrought-iron or steel pipe.

e. Outside Conductors. 1. When outside conductors or down spouts of sheet-metal are connected with the house drain, they shall be so connected by means of not less than one length of cast-iron pipe extending vertically at least 1 foot above the grade line.

2. Along public driveways without sidewalks they shall be placed in niches in the walls, protected by wheel guards, or enter the building through the wall at a 45° slope at least 12 feet above the grade.

f. Defective Conductor Pipes. When an existing sheet-metal conductor pipe within the walls of any building becomes defective, such conductor shall be replaced by one which conforms to this Code.

g. Vent Connections with Conductors Prohibited. Conductor pipes shall not be used as soil, waste, or vent pipes, nor shall any soil, waste, or vent pipes be used as conductors.

h. Subsoil, Foundation, Clear Water, and Absorption Tile Drains. Where subsoil drains are placed under the cellar floor or used to encircle the outer walls of a building, the same shall be made of open-jointed drain tile or earthenware pipe, not less than 4 inches in diameter and shall be properly trapped and protected against back pressure by an automatic back-pressure valve accessibly located before entering the house sewer or drain. They may discharge through a cellar drain.

i. Subsoil Drains Below Sewer Level. Subsoil drains below the main sewer level shall discharge into a sump or receiving tank, the contents of which shall be automatically lifted and discharged into the drainage system above the cellar through some properly trapped fixture or drain.

Sec. 3914. Inspections and tests.

a. Inspections. All piping, traps, and fixtures of a plumbing system shall be inspected by the Superintendent or his representative to insure compliance with all the requirements of this Code and the installation and construction of the system in accordance with the approved plans and the permit.

b. Notification. 1. It shall be the duty of the plumber to notify the Superintendent and the owner, or his authorized agent, orally, by telephone, or in writing, not less than eight working hours between the hours of 8 a. m. and 4 p. m. before the work is to be inspected or tested.

2. It shall be the duty of the plumber to make sure that the work will stand the test prescribed before giving the above notification.

3. If the Superintendent finds that the work will not stand the test, the plumber shall be required to renotify as above.

c. Material and Labor for Tests. The equipment, material, power, and labor necessary for the inspection and test shall be furnished by the plumber.

d. System Tests. All the piping of a plumbing system shall be tested with water or air. After the plumbing fixtures have been set and their traps filled with water, the entire drainage system shall be submitted to a final inspection and a dated record shall be filed with the Building Department. The Superintendent may require the removal of any cleanouts to ascertain if the pressure has reached all parts of the system.

e. Methods of Testing. 1. Water Test. The water test may be applied to the drainage system in its entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening above the roof and the system filled with water to the point of overflow above the roof.

2. If the system is tested in sections, each opening shall be tightly plugged, except the highest opening of the section under test, and each section shall be filled with water; but no section shall be tested with less than a 10 foot head of water or a 5 pound pressure of air. In testing successive sections at least the upper 10 feet of the next preceding section shall be retested, so that no joint or pipe in the building shall have been submitted to a test of less than a 10 foot head of water or a 5 pound pressure of air.

3. Under any test the water or air pressure shall remain constant for not less than 15 minutes without any further addition of water or air.

f. Order of Tests. The tests may be made separately, as follows:

1. The house sewer and all its branches from the property line to the house drain.

2. The house drain and yard drains, including all piping to the height of 10 feet above the highest point on the house drain, except the exposed connections to fixtures.

3. The soil, waste, vent, inside conductor, and drainage pipes which would be covered up before the building is inclosed or ready for completion. The tests required for 2 and 3 may be combined.

4. The final test of the whole system.

5. After each of the above tests has been made and proved acceptable the Superintendent shall issue a written approval.

g. Covering of Work. No drainage or plumbing system or part thereof shall be covered or a lathing permit issued until it has been inspected, tested and approved as herein prescribed.

h. Uncovering of Work. If any house drainage or plumbing system or part thereof is covered before being regularly inspected, tested, and approved, as herein prescribed, it shall be uncovered upon the direction of the Superintendent.

i. Defective Work. If inspection or test shows defects, such defective work or materials shall be replaced and inspection and tests repeated.

j. House Sewer and House Drain Tests. The house sewer and house drain shall be tested with water or air. The water test shall have not less than a 10-foot head of water and the air test not less than a 5-pound pressure. All alterations, repairs, or extensions, which shall include more than 10 feet, shall be inspected and tested.

k. Conductor Pipes. Conductor pipes and their roof connections within the walls of buildings, or conductor branches on the outside system where such branches connect with the house drain or are less than 3 feet from the wall of the building, shall be tested by the water or air test. Conductor branches on the outside system may be tested in connection with the house drain.

l. Stable and Stable-Yard Drain Test. If a stable or any part of a stable be used for human habitation, the same inspections and tests of plumbing and drainage systems thereof shall be made as in the case of an ordinary dwelling. Otherwise, all stable and stable-yard drains shall be inspected, but need not be tested.

m. Garage and Drainage System. For a garage or any part of a garage the same tests and inspection of the plumbing and drainage system thereof shall be made as in the case of an ordinary dwelling.

n. Test of Water-Distribution System. Upon the completion of the entire water-distribution system it shall be tested and proved tight under a water pressure not less than the maximum working pressure under which it is to be used.

o. Air Test of Defective Plumbing. The air test shall be used in testing sanitary condition of the drainage or plumbing system of all buildings where there is reason to believe that it has become defective. In buildings condemned by the Superintendent because of unsanitary conditions of the plumbing system the alterations in such system shall not be considered as repairs, but as new plumbing.

p. Inspections and Tests Not Required. No tests or inspections shall be required where a plumbing system or part thereof is set up for exhibition purposes and is not used for toilet purposes and not directly connected to a sewerage system; nor after replacing faucet, or valve by a new one (to be used for the same purpose); nor after forcing out stoppages and repairing leaks.

Sec. 3915. Maintenance.

a. Defective Fixtures. All installed fixtures found defective or in an unsanitary condition shall be repaired, renovated, replaced, or removed within 30 days upon written notice from the Superintendent.

b. Temporary Toilet Facilities. Suitable toilet facilities shall be provided for the use of workmen during the construction of any building. These toilet facilities shall be maintained in a sanitary condition.

Sec. 3916. Steam exhausts.

1. No steam, vapor, or water of a temperature over 130 degrees

Fahr. shall be discharged from any premises into any sewer, drain, or catch-basin, nor shall any matter or thing be discharged into any sewer which may tend to cause an obstruction of the public sewer or a nuisance or a deposit therein or any injury thereto.

2. All high-pressure steam boilers shall be connected with a blow-off tank of a capacity not less than 30 per cent of the largest boiler connected with such tank. The location of, and the connections, to such blow-off tank shall be subject to the approval of the Superintendent. No steam exhaust or steam drip, unless it be provided with a cooling tank of a capacity approved by the Superintendent, or unless it be connected with the blow-off tank, shall connect with any drain leading to the sewer. Every blow-off tank shall be supplied with a vapor pipe not less than 4 in. in diameter, which shall be carried at least 3′-0″ above the roof and above the highest windows of the building.

3. The Superintendent may require such additional means for cooling the blow-off tanks by the injection of cold water or otherwise as may be necessary to reduce the temperature of the water passing from the blow-off tank so that it shall not exceed 130 degrees Fahr.

Sec. 3917. Drip or overflow pipes.

All drip or overflow pipes from water-supply tanks or exhaust from water lift, etc., shall be extended to some place in open sight, and in no case shall any such pipe be connected directly with the drain pipe. No waste pipe from a refrigerator or other receptacle in which provisions are stored shall be connected directly with the drain pipe. The waste pipes from all other fixtures shall be connected directly with the drain pipe. Refrigerator wastes connecting with two or more stories shall be supplied with a trap on the branch for each floor and extended through the roof.

Sec. 3918. Septic tank.

a. General. Whenever a public sewer is not available, and there is sufficient ground for the purpose, a septic tank of approved type may be used, provided all the effluent from the tank can be disposed of by sub-surface drainage and provided there is no danger of contaminating a spring or other source of water-supply. A permit will be issued by the Superintendent to the person responsible for the satisfactory installation of such system. Said permit will require the person responsible to comply with the prescribed specifications and that he notify the Superintendent when ready for inspection. In no case shall the work be covered without inspection by the Superintendent or his representative. This permit becomes void when a sewer is available. Said tank and drainage system must be abandoned and a sewer connection be made when public sewer is completed.

b. Construction and Location. 1. No tank shall be placed within ten feet of any dwelling, five feet of any lot line, or fifty feet of any private water-supply used for drinking purposes. All house drainage (except roof water, yard drainage, power washer, overflows and other clear water, which shall be connected to dry wells) shall be connected with the septic tank.

2. The septic tank shall have not less than two compartments and shall have a capacity of not less than 600 gallons or 20 gallons per person per day, whichever is the greater. Each compartment shall be constructed of water-tight reinforced concrete or masonry.

3. The connection of the house sewer or drain may be of 6-inch vitrified tile pipe with cemented joints 10′-0″ from the building or 4″ extra heavy cast iron pipe.

4. The top of the tank shall be about 20 inches below finish grade and shall be equipped with manhole covers for cleaning purposes.

c. Drainage Tile Field. Four-inch land tile shall be used for the disposal of the effluent. Forty feet of said tile per room (excluding bath, halls and unfinished storage rooms) is required. In any case a minimum of 150 feet is required. This land tile shall be laid level on 6 inches of cinders in trenches dug 2 feet deep. After being carefully placed the joints shall be covered with a piece of tar roofing paper. Cinders shall then be placed in trenches so as to cover the tile pipes completely. Trenches shall then be filled with well tramped earth. Trenches shall be 5 feet apart and, wherever lot permits, 10 feet apart.

Sec. 3919. Cesspools.

A leaching cesspool may be used in place of septic tank where there is no public sewage system available and where the soil is of good porosity and proper seepage will be assured. Such cesspools shall be built only with the approval of the Superintendent and only after a permit has been obtained from the Building Department.

The cesspool shall be constructed of brick or stone without mortar (except that Portland cement mortar shall be used in the arch above the inlet pipe); the materials used shall be strong and durable; the walls shall be at least 10 inches thick; the top shall be arched and fitted with a movable opening at least 20 inches in diameter. The cesspool shall be located at least 10 feet from any property line, 20 feet from a dwelling and 100 feet from a private water-supply that may be used for drinking purposes. The house sewage or drain line shall enter the cesspool at a point 2 feet below the finish grade. The cesspool should be dug to gravel wherever possible. No overflow is permitted from the leaching cesspool (except through land tile and underground drainage where necessary) and no pipe or branch of this tile underground drainage system shall discharge so as to permit sewage to flow upon the ground or into a water course. For single family houses of 3, 4, 5, 6 or 7 rooms and for two-family houses of 6 rooms or less, the leaching cesspool shall be at least 6 feet inside diameter and 8 feet deep below the inlet pipe. For single houses of 8, 9, or 10 rooms and for two-family houses of 7, 8 or 9 rooms, the leaching cesspool shall be at least 8 feet in diameter and 8 feet deep below the inlet pipe. For two-family houses of 10, 11 or 12 rooms, the leaching cesspool shall be at least 10 feet in diameter and of a depth of 8 feet below the inlet pipe. Sizes for larger houses shall be figured in proportion. As soon as it is possible to connect with a public sewer, the owner must have the cesspool disinfected and filled with clean earth to the satisfaction of the Superintendent, and have a sewer connection made in the manner herein provided.

PART XL.

Gas Fitting.

§ 4001. General.
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§ 4014. Penalty.

Sec. 4001. General.

Gas fitting shall mean the work of putting together any fitting, pipe, fixtures, or other appliances, which are to contain gas for heat, light, or power purposes; provided however, that gas fitting shall not be construed to mean minor repairs to appliances, servicing of appliances, or the setting or renewal of gas meters.

Sec. 4002. Permits and license.

1. Every gas fitter, before doing any gas fitting in a building or structure shall obtain a permit from the Superintendent, and such permit shall be issued only to a licensed gas fitter, as required under Section 212 of this Code.

2. The work of gas fitting may be done by a journeyman gas fitter, for whom a licensed gas fitter shall be responsible.

Sec. 4003. Inspection.

1. No pipe or fitting shall be covered or concealed from view until inspected by the Superintendent or his representative.

2. All work shall be installed in accordance with the permit granted complete in all details, properly fastened and made tight, before making appointment for inspection. Twenty-four hours' notice shall be given the Superintendent on all appointments for in-

spection. The lathing permit required under Section 210, f, will be issued only after final approval is given for piping.

Sec. 4004. Lighting fixtures.

All lighting fixtures shall be approved by the Superintendent before installation.

Sec. 4005. Turning gas on.

a. On New Work. Gas shall not be turned on in a building or turned on in any new fit contained in a new or old building until the piping, fixtures, appliances and the work performed has been approved by the Superintendent.

b. After a Fire. The gas shall not be turned on in any gas fit that has been exposed to fire, prior to obtaining approval from the Superintendent.

Sec. 4006. Materials and workmanship.

1. All materials shall conform to the standard specifications of the A.S.T.M. for steel, wrought iron, cast iron, copper and brass pipe respectively. Cast-iron pipe shall be used only underground or outside of structures.

2. All gas pipes shall be of the best quality wrought iron or steel. All fittings shall be malleable, cast iron, or brass screwed fittings, and shall be used as approved by the Superintendent. The use of unions or running threads shall be permitted in open work only. Right and left couplings may be used in concealed and open work. Unions shall be made with a ground metal seat.

3. Approved seamless drawn well annealed copper, brass or other approved non-ferrous tubing with approved fittings may be used for permanent connections of stationary appliances.

4. No second-hand pipe shall be used in any building without the written permission of the Superintendent.

Sec. 4007. Size of pipes.

1. Iron or steel gas pipe, shall be proportioned so as to give an adequate volumetric flow of gas to all lighting, cooking and heating fixtures or appliances supplied or intended to be supplied from the piping system, but in no case shall they be less than the following table:

TABLE 4007A.

Showing capacity of pipe of different diameters and lengths in cu. ft. per hour with pressure drop of 0.3 in. and specific gravity 0.60. Refer to Table 4010A for maximum demand required, in cu. ft. per hour, for gas appliances.

Length of Pipe	Diameter of Pipe in Inches									
Feet	½	¾	1	1¼	1½	2	3	4	6	8
15	76	218	440	750	1220	2480	6500	13880	38700	79000
30	55	155	320	535	850	1780	4700	9700	27370	55850
45	44	124	260	435	700	1475	3900	7900	23350	45600
60	38	119	226	380	610	1290	3450	6800	19330	39500
75	..	97	200	345	545	1120	3000	6000	17310	35300
90	..	88	180	310	490	1000	2700	5500	15800	32250
105	..	80	168	285	450	920	2450	5100	14620	29850
120	..	..	158	270	420	860	2300	4800	13680	27920
150	..	..	140	242	380	780	2090	4350	12240	25000
180	..	..	128	225	350	720	1950	4000	11160	22800
210	..	..	...	205	320	660	1780	3700	10330	21100
240	..	..	...	190	300	620	1680	3490	9600	19740
270	..	..	...	178	285	580	1580	3250	9000	18610
300	..	..	...	170	270	545	1490	3000	8500	17660
450	..	..	...	140	226	450	1230	2500	7000	14420
600	..	..	...	119	192	390	1030	2130	6000	12480

2. No main pipe installed in any building shall be less than ¾ inch in diameter unless permitted by the Superintendent.

Sec. 4008. Installation of gas piping.

a. General Requirements. 1. All piping and fixtures shall be securely fastened to permanent construction and in a manner satisfactory to the Superintendent.

2. Pipes shall be laid above the timbers, and shall be run and laid to avoid any strain or weight on same, except that of fixtures.

3. All joints and connections on piping, fittings, fixtures and appliances, shall be made with red lead, white lead, or other approved compound, applied to the male thread only.

4. Pipes shall be run straight, without sags or traps and pitched so as to drain back to the riser, and from the riser to the meter. Drops shall be secured with at least one solid metal strap.

5. Branch outlet pipes shall be taken from the top or side of horizontal lines.

b. Service Pipes. 1. The service pipe must have connected to it, close to the foundation wall, an extra heavy malleable iron tee and the end on the run opposite the service shall be reduced to ¾ in. and be plugged with a three-quarter in. nipple and cap. The outlet side shall have connected to it a close nipple and L, with a main shut-off cock made into the L. In buildings of more than one riser, each inlet riser or group of meters shall have connected to it, in the cellar, a shut-off the same size as the riser.

2. Piping installed in cold or damp places, shall be properly dripped, painted with two coats of red lead and linseed oil and protected in a manner satisfactory to the Superintendent.

3. Inside services shall be tested by the fitter who receives the permit to connect the service. Connections for the meter must be installed and the service connected when the test is made.

c. Gas Pipe Outlets. 1. New outlets for gas ranges shall have a diameter not less than ¾ inch, and all ranges and heaters shall have a tee handle cock on the service pipe. When several appliances are used from one supply pipe, the supply pipe must be provided with a shut-off to control all.

2. Alteration work and new fits in old buildings on each floor shall have no outlets except those that are supplied by the meter for that floor, and any outlet that may be connected to any other meter shall be disconnected and plugged under the floor or back of the plaster and be covered. Outlets shall be capped until fixtures are attached.

Sec. 4009. Setting of gas meters.

1. The setting of meters, by the gas company, shall not take place until a certificate of approval has been issued by the Superintendent, certifying that the gas pipes and fixtures comply with the provisions of this Code.

2. All new meter connections are to be made with rigid iron connections of a type approved by the Superintendent. Meters shall be adequately supported and connected to the piping so as to exert no undue strain on the connections.

3. Meters shall not be located nearer than 12 inches to any electric cutouts, switches, meters, or other exposed live metal parts.

4. Meters shall be placed in open cellars or basements with free

access to service pipe and the main cock. Other locations for meters shall be made only with the approval of the Superintendent.

5. There shall be a brass cock or valve according to the size of fit, at the inlet side of every meter. Iron valves shall not be used.

6. When the meter sets near the service pipe, and not over 8 feet of piping is used to connect the inlet side, the cock at the inlet may be left off, provided in all cases that the cock at the service tee may be readily reached.

Sec. 4010. Appliances.

a. Only Approved Appliances to Be Used. Where gas appliances and safety devices are used, they shall be those approved by the American Gas Association. When, because of the novel or unusual character of an appliance or device, no provision has been made for its testing and approval by officially recognized agencies, the approval of the Superintendent shall be secured before such an appliance or device shall be used.

TABLE 4010A.

TABLE SHOWING MAXIMUM DEMAND REQUIRED FOR COMMON GAS APPLIANCES.

Appliance	Demand Thousands of B.T.U. per Hour	500 B.T.U. Cubic Feet of Gas per Hour
Domestic gas range (4 burner top)	75	150
Domestic gas range (6 burner top)	108	215
Hotel range, per section	135	270
Domestic hot plate or laundry stove	12	25
Domestic circulating water heater	30	60
Domestic storage water heater	30	60
Instantaneous water heaters per each 2 gal. per minute of capacity	75	150
Gas fired boiler per horsepower	45	90
Gas steam radiator per section	2	4
Gas log or radiant heater	25	50
Other domestic space heaters and central house heating systems, per room	35	70

b. Attachments. 1. No device or attachment shall be installed on any appliance which may in any way impair the combustion of the gas.

2. Any combination of appliances, attachments or devices used together in any manner shall meet the requirements which apply to individual appliances.

c. Electric Ignition and Control Devices. No device employing or depending upon an electrical current shall be used to control or ignite a gas supply if of such a character that failure of the electrical current could result in the escape of unburned gas or in failure to reduce the supply of gas under conditions which would normally result in its reduction unless other means are provided to prevent the development of dangerous temperatures, pressures or the escape of gas.

d. Supporting Appliances. Appliances shall be adequately supported and so connected to the piping as not to exert undue strain on the connection.

e. Air under Pressure. When air or oxygen under pressure is used in connection with any gas supply, effective means shall be provided to prevent the air or oxygen from going back into the gas piping.

f. Location of Gas Fixtures and Appliances. 1. Appliances are, in nearly all cases, designed and approved for placing at least six inches from any combustible material including a lath and plaster wall. This distance shall be maintained if possible; when it is not possible to maintain this distance the combustible material shall be adequately protected, as approved by the Superintendent. This is not meant to exclude appliances designed for flush to wall installations when they are approved by the Superintendent.

2. All appliances of any description that can be connected rigidly shall be so connected in accordance with Section 4006.

g. Auxiliary Gas Water Heaters. 1. Auxiliary gas water heaters connected to hot water boilers, as set in kitchens in dwellings, shall have a supply of not less than ½ inch.

2. Water heater shall not be installed in bathrooms, bedrooms, or any occupied room normally kept closed.

h. Gas Fired Boilers and Furnaces and Conversion Burners for House Heating.—1. General. a. These regulations are intended for application only to low pressure heating systems. Such systems shall be defined as those wherein the pressure does not exceed 15 pounds.

b. No gas fired boilers or furnaces for heating a building or buildings shall be installed and no boiler or furnace designed for other fuels shall be converted to the use of gas fuel unless the following regulations are complied with.

c. Either a thermostatic pilot light, so constructed and adjusted that no gas can flow through the main burner unless the pilot light is burning, or some other similar type of safety device serving this same end shall be employed. The operation of the safety device shall not depend on the closing of an electric circuit to shut off the main gas supply.

d. The boiler or furnace shall be equipped with safety devices arranged to limit high steam pressures or water temperatures or high air temperatures in warm-air furnaces which are equipped with air circulating fans. It is recommended that in steam or vacuum vapor boilers means be provided to guard against firing a dry boiler or one in which the water is dangerously low and that in warm-air furnaces not equipped with air circulating fans means be provided to guard against excessive temperatures in the distributing system. Safety devices operated electrically shall not depend upon the closing of the circuit to shut off the main gas supply. This requirement should not be construed as prohibiting the use of electrical regulating devices, provided the required safety devices are also installed.

e. An approved gas pressure regulator of sufficient size shall be installed in the gas line leading to the appliance.

f. Every gas boiler or furnace shall be connected to a flue. The section of the flue pipe between the outlet of the appliance and the draft hood shall be not less than one square inch per 7,500 hourly B.T.U. input. In no case shall this section be less than three inches in diameter, and it should not be larger than the next integral inch diameter above the size required by this rule.

g. A flue pipe from a gas boiler or furnace, gas conversion burner, or space heater, may have a lock damper of approved type inserted with a by-pass opening provided at least equal to 20% of the free area of the pipe.

h. Where dampers are an integral part of the boiler or furnace, they shall be removed or permanently secured in the open position, except such dampers the function of which is to alter the passage of the flue gases through the appliance;

which shall be locked in a position that does not interfere with the normal operation of the burners.

i. A draft hood of approved design where required or its approved equivalent shall be placed in and made a part of the flue pipe from an appliance, or in the appliance itself.

2. *Burners.* a. Conversion burners shall consist of factory assembled and tested units accompanied by complete and comprehensive installation and operation instructions that observe the foregoing and following features.

b. This will not exclude the use of any burner assembled locally, with all the necessary approved controls, when such burner is inspected and approved by the Gas Co. and the Superintendent.

c. The equipment shall incorporate acceptable provisions for adjustment, control, support and attachment to the heating plant or to the foundation on which it rests. It shall be installed (and attached) as to prevent twisting, sliding, or dropping out of the intended correct position.

d. Installation and assembly shall be such as to permit ready accessibility for inspection, repair, and replacement of parts.

e. Each burner shall be installed with a properly designated manually operated shut-off valve, in the main gas supply line to the burner. This valve shall be positioned at a point readily accessible for use and inspection.

f. Burners should be supplied by an independent gas line direct from the meter.

i. Flue Connections. 1. Every gas appliance having a demand in excess of 37,000 B.T.U. (70 cubic feet) per hour and all automatically controlled appliances shall be connected to an effective flue. Because of their intermittent use, the domestic size gas range and the hand-controlled water heater may be exempt from the requirement for a flue connection. Under certain conditions space heaters may be installed without flue connections by permission of the Superintendent.

2. Water heaters classed as observation heaters with no remote control and equipped with safety-device to shut off gas to the main burner in the event the pilot flame is extinguished shall be exempt from the requirements of this section.

3. Automatic controlled appliances having a demand rating not greater than 13,290 B.T.U. (25 cubic feet per hour) and equipped with an effective device which will automatically turn off the gas to

the main burner in the event that the flame is extinguished, shall be exempt from the requirements for a flue.

4. When two or more appliances installed in the same room have an aggregate demand at normal rating which exceeds 30 B.T.U. per hour per cubic foot of room content, any one or more appliances shall be connected to a flue to reduce the aggregate demand of appliances, not connected to a flue, to 30 B.T.U. per hour per cubic foot of room content.

5. Automatically controlled gas appliances which connect to flues of other fuel burning appliances shall be equipped with an effective device which, in the event that the constantly burning flame of pilot light is extinguished, will automatically shut off the gas supply to the main burner or burners.

6. For the purpose of this rule "automatically controlled appliances" shall not include appliances equipped with devices or controls governing the supply of gas to the main burner or burners which cannot automatically reduce the supply below thirty per cent of the "maximum" demand.

7. Every flue connected appliance except an incinerator, unless its construction serves the same purpose, shall be equipped with an approved and effective draft breaker. In general the cone type draft hood, where used, shall be placed in a vertical position adjacent to the appliance.

8. Flue Connection Effective. Before making a flue connection, the chimney or flue shall be examined to ascertain that it is properly constructed, clear, and will normally conduct the products of combustion to the outer air.

9. The vent pipe or connection shall not be smaller than the size indicated by the vent collar of the appliance, with a minimum diameter of 3 inches.

10. Materials. The materials used for the vent pipe, from the gas appliance to the draft breaker, shall be of any approved type. However, the materials used from the breaker to the chimney flue, outlet pipe, or outside air, shall be of 16 oz. copper.

j. Flues or Outlet Pipes for Gas Appliances. Type A: Lined chimneys or metal stacks (see Part XXXIV of this Code) are required for all incinerators and all appliances, the normal operation of which at maximum input rating produce flue gas temperatures in excess of 550 degrees F. at the outlet of the draft hood.

Type B: Outlet pipes of incombustible, non-corrodible material of sufficient thickness, cross-sectional area, and heat insulating quality to avoid temperatures in excess of 160 degrees F. on adjacent combustible material, with bell and spigot or other acceptable joints. Where extending through from story to story to roof, located inside partitions or walls, or extending through walls to the outside shall have one inch clearance from all combustible materials.

Type C: Outlet pipes equal to soil pipe or standard steam or water pipe having acceptable joints and relatively low heat-insulating value. Where extending through from story to story to roof, located inside partitions or walls, or extending through walls to the outside shall be encased in an incombustible jacket with one inch air space, the encasing jacket or duct to be open at the top and bottom and to be continuous its entire length.

Note: Outlet pipes of Type B and C may, in general, be used with domestic appliances which have been tested when burning gas at a rate of 25 per cent above the manufacturer's input rating and found to produce no temperature above 550 degrees F. at the outlet of the draft hood.

Sec. 4011. Gas engines and other large appliances.

1. The pipe to supply gas to a gas engine or other appliance of large consumption or high momentary demand shall, in every case, be carried back far enough independent of other piping, or other provision be made, to ensure that the pressure at the other appliances is not disturbed by the operation of this appliance to the extent of affecting satisfactory performance.

2. Each gas engine shall be equipped with an approved anti-fluctuating device installed as near the engine as practicable. A gas bag, if used to reduce pressure fluctuations shall be enclosed in a substantial gas-tight metal drum of approved construction, vented to the outer air through a pipe used for no other purpose, and the outer end equipped with a protected turned-down fitting to prevent clogging.

3. The exhaust pipe of a gas engine shall be run to the outside air, preferably above the roof.

4. The sizes of pipe used in connecting gas engines shall be as approved by the Superintendent.

Sec. 4012. Test of gas piping.

1. Every new or enlarged system of gas piping shall be air tested by the gas fitter when the roughing-in is completed and before the lathing and plastering is begun. This test shall be made by having

all openings closed and subjecting the piping to an air pressure test that will support, without visible settlement, a column of mercury six inches in height for at least fifteen (15) minutes.

2. After the fixtures are placed, they shall be tested by two (2) inches of mercury, which must stand five (5) minutes.

3. Spring or steam gauges shall not be used in testing.

4. Filling gas pipes with water or liquid is prohibited. No piping that has contained water or liquid shall be tested or approved.

5. All tests shall be made in the presence of the Superintendent or his representative.

6. Upon proof of a satisfactory test, the inspector shall issue a certificate of inspection to the gas fitter. Said certificate shall state the work covered by the inspection.

Sec. 4013. Defective work.

The Superintendent or his duly authorized representative may inspect existing or new gas fitting at any reasonable hour, and if he finds it unsafe, dangerous to life, limb or property, or likely to become so, or if he finds any new installation to be in violation of the requirements of this code, shall notify the owner, or any other person having an interest therein, to repair same. If such installation is not corrected within five (5) days of such notice, the Superintendent shall, in writing, order the person, firm or corporation that furnishes the gas, to discontinue the service or may otherwise render said installation inoperative. The person, firm or corporation that receives such an order shall, within twenty-four (24) hours, comply with the order. Such an installation shall not be reconnected, nor have the gas turned on, until a certificate of approval has been issued by the Superintendent.

Sec. 4014. Penalty.

Whoever violates any provision of this Part, shall be liable to a penalty not exceeding fifty (50) dollars.

PART XLI.

Electrical Wiring.

§ 4101. General.
§ 4102. Permits.
§ 4103. Inspection.
§ 4104. Meter and current.
§ 4105. Approved methods of interior wiring.
§ 4106. Approved methods of exterior wiring.
§ 4107. Meter mains, switches and locations.
§ 4108. Electrical equipment.
§ 4109. Penalty.
§ 4110. Repeal.

Sec. 4101. General.

1. The Superintendent shall have control of the supervision and inspection of building wiring; and shall enforce all laws, ordinances and regulations that relate thereto. Where the word "Superintendent" is used in this part, it shall also mean his duly authorized representative.

2. Except for the requirements of this part, all new electrical wiring shall be constructed in conformity with the regulations of the current National Electrical Code, as published by the National Board of Fire Underwriters.

3. Electrical wiring shall include the new installation, repair, extension, or alteration of wires, conduits, apparatus, fixtures or other appliances within or on the building or other structure, or relating thereto, for carrying or using electricity for light, heat, or power, or for a signalling system, except in state and federal buildings, and except in stations, sub-stations, and vaults where such are under the sole control of the supply company, and except for wires and equipment installed by public utilities who regularly install and own the wiring for their systems, such as, The New England Telephone and Telegraph Company, The Western Union and Postal Telegraph Companies, The American District Telegraph Company, and the Cambridge Electric Light Company, and except for signal wires employing less than 90 volts installed in their own buildings by organizations employing one or more full time licensed electricians.

4. In accordance with Chapter 141, Section 1 of the General Laws, no person, firm or corporation shall engage in the business of a master electrician or work as a journeyman electrician unless he is lawfully licensed by the state examiners or electricians. Every master electrician's license, or certificate, shall at all times be displayed within his place of business. The license of a journeyman

electrician shall be exhibited whenever required by the electrical inspectors.

Sec. 4102. Permits.

1. Before any person, firm, or corporation shall install any electrical wiring as defined above, said person, firm, or corporation shall make application to the Superintendent for a permit. Such an application shall be made upon a form furnished by the Superintendent.

2. If it shall appear from said application that the statutes and this code will be complied with, a permit will be granted authorizing such electrical wiring, after the required fee, specified in Section 208 of this code, has been paid.

3. For "emergency repairs" and maintenance of electrical wiring in buildings and structures or power plants, where a licensed electrician is employed continuously on the premises, permits will be issued for stated periods. The period for such a permit shall not exceed one year. For new work, paragraph 1 of this section shall apply.

Sec. 4103. Inspection.

1. When any work or portion of work is completed or ready for inspection, the Superintendent shall be notified immediately. Upon receiving notice that any electrical wiring is completed or ready for inspection, the Superintendent shall act on such notice within 2 working days. The Superintendent may require the person who did the work to be present during the inspection. If, upon inspection, the work is found to comply with the requirements of this code, a certificate of approval shall be issued by the Superintendent covering the work inspected, but, if the work is defective, all defects shall be remedied before such a certificate is issued. All wiring, conduits or fittings in new construction shall not be lathed in, covered or concealed from view until approved by the Superintendent, as required in Section 210.

2. The Superintendent may inspect electrical wiring at any reasonable hour, and, if he finds it unsafe, dangerous to life, limb or property, or likely to become so, or if he finds such installation to be in violation of the requirements of this code, shall notify the owner, or any person having an interest therein, to repair the same; and may order the service discontinued or otherwise render the system inoperative. Such an installation shall not be connected to the service, nor have current turned on, until a certificate has been issued by the Superintendent.

Sec. 4104. Meter and current.

1. A meter shall not be installed, nor shall electricity be connected to any electrical wiring system, until a certificate of approval has been issued by the Superintendent.

2. The Superintendent may issue a temporary permit, allowing the electric current to be used on certain specified circuits or parts of an installation, while the work of constructing, altering or repairing such a system is in progress. A temporary permit may also be granted for an exposed wiring system within or on a building. Such permits may be renewed or canceled at the discretion of the Superintendent.

3. An electrical wiring system, where the service has been discontinued, shall not be used again until a certificate of reinspection has been issued by the Superintendent; provided, however, that the opening of the circuit or the removal or reinstallation of electric meters by the firm owning the same shall not be deemed to be a discontinuance of service.

Sec. 4105. Approved methods of interior wiring.

a. *Open wiring on insulators.* Not to be installed in commercial garages, theaters, motion-picture studios, booths, hoistways, or hazardous locations except Class IV.*

b. *Concealed knob and tube work.* Not to be installed in commercial garages, theaters, motion-picture studios, or in any hazardous location.*

c. *Bare-conductor feeders.* May be installed in fire proof buildings in dry, non-hazardous, non-corrosive locations. May be installed in storage-battery rooms.

d. *Armored cable.* Type AC may be installed in dry locations in exposed or concealed work, or embedded in plaster. Type ACL may be installed in damp locations, in underground runs, or embedded in masonry, concrete or fill. Neither type may be installed in theaters, motion-picture studios, or in any hazardous location,* in corrosive locations, in storage-battery rooms, on cranes or hoists (with exceptions*), or in hoistways or elevators (with exceptions*).

e. *Non-metallic sheathed cable.* May be installed in exposed or concealed work but not embedded in masonry, concrete, fill or plaster. May not be installed in commercial garages, theaters, motion-picture studios, storage-battery rooms, hoistways, in any hazardous location,* in breweries, ice plants, cold storage warehouses or similar mildly corrosive, wet locations but may be installed in dairy barns, chicken houses and similar locations.

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*See National Electrical Code.

f. Service entrance cable. Types SE and ASE with a rubber-covered grounded conductor may be installed with certain restrictions* in buildings. Under special conditions* Types SE and ASE with a bare grounded conductor may also be installed in buildings.

g. Non-metallic waterproof wiring. May be installed (exposed) in breweries, ice plants, cold-storage warehouses or similar wet, mildly corrosive locations if the voltage does not exceed 300 volts between conductors or 150 volts to ground.

h. Non-metallic surface extension. May be installed in one room of a residential or office building with special restrictions*.

i. Rigid metal conduit. May be installed generally except that enameled conduit may only be installed indoors in non-corrosive locations. When installed in severely corrosive locations rigid metal conduit must be made of adequate corrosion-resistant material.

j. Electrical metallic tubing. May not be installed when subject to severe mechanical injury, in cinder concrete without special protection*, in any hazardous location, or in corrosive locations with exceptions*.

k. Flexible metal conduit. May not be installed in wet locations unless conductors are lead-covered or otherwise protected, in hoistways with exceptions,* in storage-battery rooms, in hazardous locations, with exceptions*, or where exposed to materials which may destroy the insulating properties of rubber.

l. Surface metal raceway. May be installed in dry locations with special restrictions.*

m. Underflow raceway. May be installed beneath the surface of concrete or other flooring material with special restrictions.*

n. Cellular metal floor raceway. May be used in non-corrosive locations under special restrictions.*

o. Underplaster extension. May be installed in buildings of fire-resistive construction under special conditions.*

p. Wireway. May be installed (exposed) in dry locations in industrial buildings and in garages. May not be installed where subject to severe mechanical injury or corrosive vapor, in hoistways, in any hazardous location, or in storage-battery rooms.

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*See National Electrical Code.

q. Busway. Same restriction as Method P.

r. Trial installation at the discretion of the Superintendent.

Sec. 4106. Approved methods of exterior wiring.

s. Service entrance cable. May be installed on poles and on the exterior of buildings or structures.

t. Rigid metal conduit. May be installed on the exterior of buildings or structures, or underground.

u. Parkway cable. May be installed underground for service connections and between buildings without being enclosed in pipes, conduits or ducts if buried at least 18 inches below the finished grade. When installed beneath streets, driveways, sidewalks, as risers on poles located along highways, or when passing through walls, parkway cable must be protected mechanically in a manner acceptable to the Superintendent.

Sec. 4107. Meter mains, switches and locations.

1. A meter shall be located in an easily accessible place in a basement, cellar, outside of a building or in other locations when approved by the Superintendent. A complete conduit system mechanically-protected must be installed from the point of entrance through the meters to the centers of distribution.

2. Where the installation includes more than one meter, each meter switch or meter connection shall be plainly and permanently marked, either with painted lettering or a metal name plate. The marking shall give the exact location of the system which the switch or connection supplies.

Sec. 4108. Electrical equipment.

All the equipment and materials or the plans for such equipment, of the following types must be approved by the Superintendent before installation or erection unless such equipment or material has the National Fire Underwriter's stamp of approval; especially electric signs, prefabricated or portable equipment, wiring devices, appliances, fixtures, apparatus, display cases, wires and cables.

Sec. 4109. Penalty.

Whoever violates any provision of Part XLI shall be liable to a penalty not exceeding 100 dollars.

Sec. 4110. Repeal.

All ordinances or parts of ordinances inconsistent herewith are hereby repealed.

PART XLII.

Lath, Plaster, Stucco.

§ 4201. Inspection.
§ 4202. Materials.
§ 4203. Workmanship.
§ 4204. Tests.
§ 4205. Removal of work.
§ 4206. Plaster used for fire protection.

Sec. 4201. Inspection.

a. Lathing. No wall or ceiling of any building shall be lathed or otherwise covered until the Superintendent has been notified by the owner or his duly authorized agent that the building is ready for such work and he has issued a permit of approval thereof, as specified in section 210, f, of this Code.

b. Plastering and Stucco. No wall or ceiling on the interior or exterior of any building, shall be plastered or stuccoed until the Superintendent has been notified by the owner or his duly authorized agent that the lathing is completed and the building is ready for such work and he has issued a permit of approval thereof.

Sec. 4202. Materials.

The materials used for lathing, plastering and stuccoing shall meet the standard requirements of the American Society for Testing Materials for their respective kind, and all materials used shall be applied in accordance with the manufacturers' specifications.

Sec. 4203. Workmanship.

The workmanship for lathing, plastering, stuccoing and any other pertinent work to the lathing, plastering and stuccoing of a building, shall be in accordance with the best practice of the respective trade.

Sec. 4204. Tests.

If the Superintendent should deem it necessary, he may order tests to be made, by the owner or his duly authorized agent, of the materials used and the work performed.

Sec. 4205. Removal of work.

If the Superintendent should find that the work performed or the materials used do not conform with the provisions of this part, he may order such work to be removed and made to conform with this Code.

Sec. 4206. Plaster used for fire protection.

Wherever plaster is specified or permitted in this Code for fire protection, it shall be gypsum or Portland cement plaster of thickness specified and in accordance with the provisions of Part XXXVII of this Code.

PART XLIII.

Existing Buildings.

§ 4301. General.
§ 4302. Permits.
§ 4303. Required change in existing buildings.
§ 4304. Floor loads.
§ 4305. Means of egress.
§ 4306. Fire windows, doors and shutters.
§ 4307. Protection of structural members.
§ 4308. Floor area.
§ 4309. Basement or cellar.
§ 4310. Garbage chutes.
§ 4311. Time limit.

Sec. 4301. General.

All buildings and structures shall be kept in good general repair, so that all of the various parts thereof shall maintain the safety and habitability prescribed under this Code. The premises shall be maintained in a manner to conform with the provisions of this Code.

Sec. 4302. Permits.

The general maintenance work, such as painting, papering, repair of water faucets, or other similar maintenance work may be performed without a permit. Work on the repair or alteration of a building, involving structural, fire resistive, sanitary, electrical and gas piping, changes shall require a permit as prescribed under Section 207 and in conformity with Section 203, b, c, d.

Sec. 4303. Required change in existing buildings.

Such portions of an existing building not conforming with this Code for new structures may be changed or altered, as directed by the Superintendent, to protect the life and health of the inhabitants.

Sec. 4304. Floor loads.

The Superintendent may prescribe the maximum floor loads which may be imposed upon the floors of an existing building.

Sec. 4305. Means of egress.

Every existing building shall have with reference to its height, condition, construction, surroundings, character of occupation, and number of occupants, reasonable means of egress in case of fire and for this purpose the Superintendent may require that exits, corridors and stairs be, as far as reasonable, equivalent to those required for like buildings hereafter erected.

Sec. 4306. Fire windows, doors and shutters.

The Superintendent may require in existing buildings, fire doors, windows, and shutters, as far as reasonable, equivalent to those required for like buildings hereafter erected or otherwise so as to secure an equivalent degree of fire protection.

Sec. 4307. Protection of structural members.

In work in connection with alterations of existing buildings, the character and amount of protection of structural metal shall be, as far as reasonable, equivalent to that required for like buildings hereafter erected, see Table 1605.

Sec. 4308. Floor area.

No existing building shall be so altered or enlarged as to contain an unenclosed area greater than allowed in Parts VI to XV inclusive, of this Code, for buildings hereafter erected.

Sec. 4309. Basement or cellar.

The basement, cellar or lowest story of every dwelling shall be free from dampness. The Superintendent may require or order such work as may be necessary to damp-proof the cellar or basement.

Sec. 4310. Garbage chutes.

No garbage chute shall be erected in any existing building.

Sec. 4311. Time limit.

Alterations required in existing buildings shall be made within 6 months after the written notice of such requirements.

PART XLIV.

Mechanical Refrigeration.

The installation of mechanical refrigeration shall conform with the requirements of the Building Department, and when the Superintendent deems it advisable, such installation shall conform with the provisions of the "American Standard Safety Code for Mechanical Refrigeration, B9-1939."

PART XLV.

Miscellaneous Regulations.

§ 4501. Safeguard during construction.
§ 4502. Structural painting.
§ 4503. Temporary use of streets during construction.
§ 4504. Use and storage of dry-cleaning and dry-dyeing fluids.
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§ 4508. Explosives.
§ 4509. Smoke abatement.
§ 4510. Motion picture booths.
§ 4511. Toilet facilities.

Sec. 4501. Safeguard during construction.

All building or structural operations covered by this code shall comply with the rules and regulations prescribed in "Industrial

Bulletin No. 12, Rules and Regulations for the Prevention of Accidents in Building Operations" published by the Massachusetts Department of Labor and Industries, Division of Industrial Safety.

Sec. 4502. Structural painting.

All structural painting shall be performed as prescribed in "Industrial Bulletin No. 13, Revised Rules, Regulations and Recommendations Pertaining to Structural Painting" published by the Massachusetts Department of Labor and Industries, Division of Industrial Safety.

Sec. 4503. Temporary use of streets during construction.

The temporary use of streets during construction operations shall conform to the requirements of the Street Department of the City of Cambridge.

Sec. 4504. Use and storage of dry-cleaning and dry-dyeing fluids.

The use and storage of dry-cleaning and dry-dyeing fluids shall conform to the requirements as prescribed in "Rules and Regulations Form Z" of the Massachusetts Department of Public Safety.

Sec. 4505. Storage and use of fuel oil.

The use and storage of fuel oil shall conform to the requirements as prescribed in "Rules and Regulations Form F", of the Massachusetts Department of Public Safety.

Sec. 4506. Air tanks.

The construction, installation and operation of air tanks of more than 1 cubic foot capacity, or tanks which are not an integral part of lift casing, shall conform to the requirements as prescribed in "Air Tank Regulations Form J" of the Massachusetts Department of Public Safety.

Sec. 4507. Inflammable fluids, compounds, solids or gases.

The keeping, storage, manufacture or sale in limited quantities of inflammable fluids, compounds, solids or gases shall conform to the requirements as prescribed in "Rules and Regulations Governing the Keeping, Storage, Manufacture or Sale in Limited Quantities of Inflammable Fluids, Compounds, Solids or Gases Form S," Massachusetts Department of Public Safety.

Sec. 4508. Explosives.

The keeping, storage, use, manufacture, sale, handling, transportation or other disposition of explosives shall conform to the requirements as prescribed in "Rules and Regulations Governing the Keeping, Storage, Use, Manufacture, Sale, Handling, Transportation or Other Disposition of Explosives" Form Y, Massachusetts Department of Public Safety.

Sec. 4509. Smoke abatement.

The emission of smoke from burning fuel, waste material from plants, furnaces, locomotive engines and brick kilns shall be controlled in a manner to conform with Acts of 1910, Chapter 651, Acts of 1930, Chapter 380; Chapter 412 "Abatement of Smoke", under the jurisdiction of the Massachusetts Department of Public Utilities, Division of Smoke Inspection.

Sec. 4510. Motion picture booths.

Motion picture booths or enclosures shall conform to the requirements prescribed in Form C of the Massachusetts Department of Public Safety.

Sec. 4511. Toilet facilities.

For the rules and regulations governing the installation of toilets and washing facilities in industrial establishments refer to Section 133 of Chapter 149 of the General Laws and the rules and regulations compiled by the Department of Labor and Industries.

PART XLVI.

Legislative.

§ 4601. General.
§ 4602. Ordinance repealed.
§ 4603. Validity.
§ 4604. Date effective.

Sec. 4601. General.

Nothing herein contained shall require any change in the plans or construction or designated use of a building for which a building permit has been heretofore issued; nor for plans which are on file with the Superintendent at the time of the passage of this code, and a permit for the erection of which is issued within two months after the passage of this code. The construction must be commenced and diligently prosecuted within six months after the permit is issued and shall be entirely completed within two years after the passage of this code.

Sec. 4602. Ordinance repealed.

Ordinance entitled "Construction, Use, Maintenance and Inspection of Buildings" which includes the Zoning Law passed in City Council, December 31, 1923, and subsequent ordinances relating thereto, or parts thereof in force at the time this code shall take effect and inconsistent herewith, are hereby repealed.

Sec. 4603. Validity.

The invalidity of any Part, section, subsection, sentence, clause or phrase of this code shall not invalidate any other Part, section, subsection, sentence, clause or phrase hereof.

Sec. 4604. Date effective.

This code shall be, and is hereby declared to be in full force and effect, from and after 30 days from its date of final passage by the City Council.

In City Council *Dec. 27, 1943.*

Passed to be ordained.

A. True Copy.

John H. Corcoran,
Mayor.

Attest: *Frederick H. Burke,*
City Clerk.

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